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Vol. VI. NEW YORK, NOVEMBER 14, 1885. No. 20.

How the years do roll by! Thirty-four years ago yesterday (Nov. 13, 1851), the first submarine cable was opened between Dover, England, and Calais, France. The times have changed and we with them; but while the world now takes every new electrical achievement as a matter of course, our sympathies go back to the little band of anxious electricians who made that memorable essay along the gray Channel shores those dreary November days.

As we write, evidence is being heard by Secretary Lamar on the point whether the Department of Justice should or should not begin suit against the Bell Company. It looks, in fact, as though the whole case would have to be fought over again in order to show whether or not it should be fought over again. We confess we see little to be gained by an informal trial of this anomalous nature. Probably the Secretary of the Interior will soon be as sick of the subject as his esteemed but erring colleague, the Attorney General.

THE West has been a good field for electric lighting, not because the people there are distinguished for their "adamantine credulity," but because their intellectual qualities are of the opposite character to stolid stupidity, and because they are energetic and progressive. One of the latest important steps in regard to the development of the West electrically is that taken by the American Electric Manufacturing Company, as noted by us last week, in the closing of a contract with Mr. Badger, who not only turns over to it his own large electric lighting interest, but will now manage the Western interests of the company with a branch office in Chicago. This new combination has a promising appearance.

SOME months since we drew attention to the groundless fears expressed by some persons regarding the safety of the Bartholdi Statue of Liberty. One Edward Rudolf Garczynski, of Hoboken, was the originator of this hue-and-cry, asserting that the electrical action between the copper sheath and iron bracing within would lead to the certain and rapid destruction of the statue. He now again bobs up serenely, and asserts that the rusting of some of the iron, which was recently discovered, was not caused by the bilge water in the hold of the French transport, but was the effect of exposure to rain and to *the electric storms of the summer*. Here is food for thought, and Mr. G. deserves the thanks of the community at large for pointing out this new lurking foe to the stability of iron structures. We congratulate Mr. G. upon his discovery, and would only suggest that, to make it complete, he devise a means of protecting iron structures from the baneful effects of electric storms. Considering the amount of electrical talent domiciled in Hoboken, it seems indeed strange that such statements should emanate from that place.

How far behind in electric lighting Germany really is, as compared with the United States, is well exemplified in the statistics lately compiled. From these it would appear that the entire Empire does not contain more than 1,500 arc lamps in operation, a number which is reached and exceeded by each of several of our cities, New York alone having in the neighborhood of 2,500. The figures regarding the incandescent lamps are, comparatively, even smaller than those pertaining to the arc. It seems almost incredible that a country of 45,000,000 inhabitants should not have more incandescent lamps in operation than 20,000, but such appears to be the case. If, as compared with Germany, the progress of France is said to be slow, it must indeed be disheartening to the projectors of electrical enterprises abroad. This emphasizes the remark made by us, some time ago, that a few "live" Americans would find plenty of opportunity to display their energy on the continent of Europe. And yet our foreign electrical friends are men of brain and push. The trouble may, after all, lie in the fact that Europe has too much paternal and grandfatherly legislation.

THE uses of the telephone, though numerous, even to-day, are destined to be increased as time advances. Just now an experiment of considerable importance to the commercial world is being made on the east coast of England, where a lightship has been put in telephonic communication with the shore—a distance of ten miles. Although it was considered improbable that the human voice could be conducted 10 miles through a cable, especially in rough weather, this has now been shown to be thoroughly practicable. Every ship passing is duly signaled, and her name telephoned ashore, thus giving early notice of her arrival and position. Still another point in which this system has been of great benefit is the aid which it renders to ships in distress, whose definite location can be telephoned ashore, and help summoned and sent immediately in the right direction. Our government ought to look into this matter, as the adoption of such telephonic communication would be a great boon both to mariners and to merchants. Such telephone lightships would also be a valuable addition to our Signal Service, which has now become so important, and has already run telephone lines along dangerous parts of our coast.

SEEING by electricity, which the selenium cell first made a possibility, has been the study of a number of investigators, and some success has already been attained. Our article on this subject in this issue, describing a new form of apparatus in which selenium is dispensed with, bears the mark of patient toil and great intelligence. The application of the diaphragm of the telephone as a mirror, and changing its radius in accordance with the impressed currents, is a most brilliant idea, the working out of which is very aptly accomplished. We are not informed as regards the results obtained with this apparatus, but it would appear to contain all the elements for successful working with comparatively simple methods. There is little doubt that the near future will see the problem completely solved, in one way or another, and a suitable word expressive of the apparatus which constitutes the "electric telescope" seems desirable in order to avoid periphrase. We would therefore suggest the word "telectroscope," as containing all the necessary elements for a suitable expression. The first part of the word is, as will be noted, condensed, and contains the Greek *tele* and the first syllable of the word *electro*. The word is easily pronounced and memorized, so that no objection could be raised on that score. We will be pleased to receive other suggestions on this matter, in order that electrical nomenclature may be rendered as simple and as clear as possible. We are not advocates for a larger vocabulary, and we do not care for new words with strained meanings, but here is a genuine case to be met, and hence we have respectfully offered "telectroscope" as a suggestion.

A LEADING Western paper has taken the trouble to get its representatives in the thirty-three most populous cities in the country to send in figures relative to the local telephone rates and the principles upon which those rates are based. The paper shows enterprise, but has been at needless expense and work, as this information is printed by the American Bell Company in regard to every place in the United States, and could, no doubt, be had on polite application. In fact, we shall be glad to show one of our copies to any other paper wishful of entering into telephone statistics. These figures show great uniformity of method and system in fixing the rates of subscription. As the Western paper we refer to says, after mentioning the fact that local circumstances, such as density of population, number of instruments used, and length of circuits, fix the rates, "and the managements of the companies have evidently tried to graduate their charges accordingly." We need not quote the figures, as there is nothing new in them to telephonists. We may remark, however, that they show New England, where the greatest clamor has been raised against high telephone rates, to have the lowest rates in the country. This again is not fresh news, but it deserves a place just now to show how insincere and unjust is much of the present grumbling in Massachusetts and Connecticut. As we have said before, if a man can't afford a mere $50 or $60 a year for his telephone—barely a dollar a week for an instrument he will use a dozen times a day—he ought to give it up. If one of the latest and greatest benefits of civilization is not worth that much to him, the less he has to say about the rewards given by America to inventive genius, the better it will be for his consistency. As compared with the fortunes made in other fields, the amount actually made out of the telephone seems modest, and at times, to those who watch the business closely, it looks as though the profit will lessen as the use of the instrument extends, until it comes down to a very small margin.

ONE of the most interesting reports thus far issued by the Franklin Institute on the Electrical Exhibition is that which we give in this issue. The performance of good dynamo machines and their efficiency as current generators has been already practically fixed at a very high percentage, and the results show that the machines tested at Philadelphia are not wanting in this respect. It would be difficult to draw a distinction between the two sets of machines, as their performances are practically identical. Indeed, this was to be expected. Both have the Siemens armature, are shunt wound, and have been the results of long and careful experiments, whence it is not strange that the results agree so closely. While the report shows what can be expected from a well-designed machine of this type, it is very much to be regretted that the machines by other makers using the Gramme and Paccinotti types of armatures were not entered for competition. We should then have been able to compare distinct types of the most recent construction. Taking the figures as they stand, they show remarkable results in the conversion of natural forces. Thus, in several instances over 96 per cent. of the total power applied to the machines was converted into electricity, and an average of nearly 90 per cent. was available for external useful work at full load. It is, of course, to be expected that with partial loads the efficiency of the machines will diminish, but even in these cases the figures are very good, showing the machines to be well designed. Comparing the present results with those obtained in Munich in 1882, we find a most marked improvement in the performance of the Edison dynamos, the only incandescent machines tested on that occasion. It will be remarked, however, that with partial loads the efficiency of the Weston machines is slightly in excess of those of Edison, and increases as the load decreases. Whether this is to be looked for in the fact that the ratio of armature to field resistances at partial loads is as a rule greater in the Edison than in the Weston machines, is an open question. It would seem, from the results, that with decreasing load, or in other words, with increasing resistance in the external circuit, a limit is reached, beyond which added resistance in the field prevents the proportionate magnetization from reaching its proper limit, shown by an increase in the proportional energy in the field, and thus causing a loss of efficiency. Calculation also shows that the weights of the machines vary from about 110 to 150 pounds per electrica horse-power developed.

Seeing by Electricity.

It is now several years since the subject of seeing by electricity was first actively agitated, and though several experimenters have devoted considerable time and obtained varying success, the problem is still an open one.

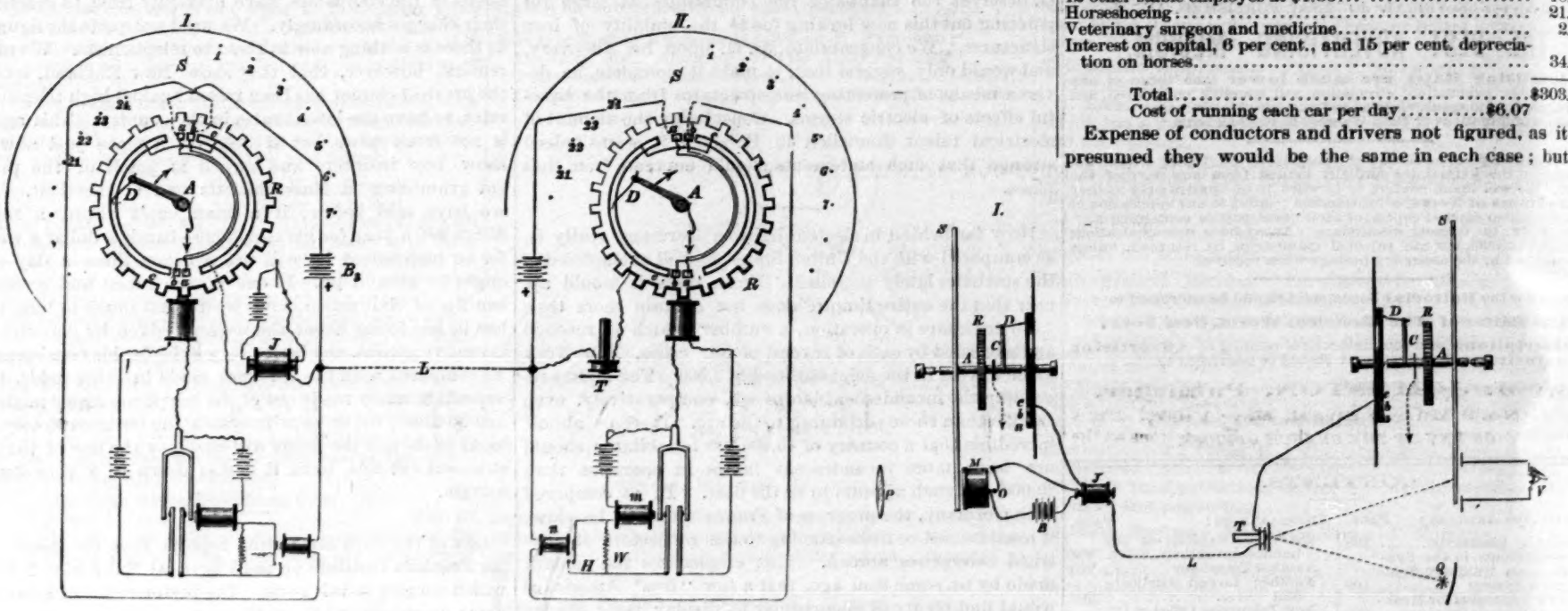
The discovery of the properties of the selenium cell gave the first stimulus to active wrestling with the question which has been attacked in various ways by d'Ardres, Bidwell, Ayrton and Perry, Bell, Carey, Connolly and McTighe and others, and one solution of it may be said to be analogous to the fac-simile telegraph. This might be done in three ways: first, instead of employing insulating ink in drawing the picture, the latter might be represented by a light picture; secondly, the insulating ink being used, the receiving apparatus might be constituted so as to project a light picture of the original upon a screen; finally, an application of both these methods in the same apparatus would justly entitle the latter to the name "electric telescope." It will be understood that in all fac-simile telegraphs there are two sets of apparatus which are kept in synchronous motion. Now, if at the sending station a small part of a light picture be transmitted to the receiving station and received by the human eye, it will be retained upon the retina for a fraction of a second. And if immediately following, another part of the light picture be transmitted it will be seen simultaneously with the first; so that, if a series of such mosaics, as it were, are rapidly transmitted, they will appear as a single light picture to the observer at the other end of the line.

Following this line of thought, Herr P. Nipkow has constructed an "electric telescope," which he claims fulfils the much desired object, and which he describes in the *Elektrotechnische Zeitschrift*. His apparatus, a most ingenious combination, consists in (1) means for maintaining synchronism of the mechanisms, and in (2) means for transforming intermittent light into intermittent electric currents, and in the retransformation of the latter into light.

He accomplishes his first object by means of the "phonic wheel" employed by Messrs. Delaney and Calahan in their synchronous multiplex telegraph system, the latest improvements in which we give in this issue. We need, therefore, not enter into the details here, which are shown in Fig. 1. Coming to the second requisite, however, the transformation of intermittent light into intermittent currents and their retransformation, Herr Nipkow, while acknowledging the adaptability of selenium for the purpose, has been able to dispense with it entirely by using a lamp-black drum designed by himself. This drum *M*, Fig. 2, is an ordinary box, one end being closed by a glass plate and the other by a diaphragm, the interior being filled with wire gauze covered with lamp-black.

The diaphragm also carries a carbon contact *O*. Now, when intermittent light falls upon the glass plate, the diaphragm vibrates correspondingly, varying the resistance of the carbon contact so that pulsations are generated in the primary of the coil *J* and battery *B*, which are, of course, reproduced in the secondary. The intermittent currents from the latter are transmitted to the station marked II., and have a corresponding effect upon the telephone *T*. *This telephone has a polished reflecting diaphragm;* consequently, if a beam of light be projected upon the latter, it will have a certain diameter at a given distance from the telephone. Now, if the diaphragm is converted into a concave mirror by the action of the current, the reflected beam will have a smaller diameter than formerly at the same distance, or, in other words, a surface intercepting the ray at that point will, in the latter case, be illuminated more brilliantly than in the former. In this way the slightest current variations can be transformed into most marked light changes, for which purpose all that is required is to place the telephone as far as possible from the source of light, and to make the latter as intense as possible. The diagram Fig. 1 shows the manner in which the currents induced in the coil *J* are led to the two semi-circular strips *c c*, which are connected to the line through the secondary of the induction coil, and thence to the telephone at the other station.

In order to divide up the picture to be transmitted into a mosaic, as mentioned above, so that every part of the field can be examined as to its illuminating power, a large disc *S* is attached to the shaft *A*, as shown in Fig. 1, *S* being represented in part only. This disc is divided into a number of sectors, two of which correspond to the connecting contacts *a*, *b*, placed between the strips, and those parts of the disc are not utilized in the reproduction of the picture. The remaining part is divided into 24 segments, and the radii dividing the sectors are perforated in such a manner as to make each successive hole approach a constant distance towards the centre, as shown in Fig. 1; so that, if the disc be rapidly revolved, there will be seen a ring of light, the width of which is equal to the radial distance between perforation 1 and 24. If, as in Fig. 2, an image be thrown upon the disc *S*, through a lens *P*, and so screened that its length does not exceed the radial distance between 1 and 24, and its width the distance between 1 and 2, it follows that only one perforation can be within the area of the picture at any one time. Hence, an observer on the other side of the disc would see the image in a series of lines or stripes, each one of which is formed successively. In this way each portion of the picture can be examined as to its illuminating power, and any number of these pictures following in rapid succession can be analyzed, a most important point in this "electric telescope." A picture, being composed of lights and shades, will therefore produce an intermittent light behind the disc. This changing light falls upon the lamp-black drum which transforms the light vibrations into undulating currents through the medium of the induction coil *J*. At the station II., Fig. 2, there is a disc *S*, similar to the one described above, mounted upon a shaft *A*. The receiving telephone is placed at a suitable distance on one side of the disc and the observer on the other, the disc being so screened that he can only observe a surface similar to the one described, upon which the image is formed on the disc at the sending station I. The screen is arranged so that the corresponding holes enter its field at the same instant. The illuminating telephone must be so arranged as to reflect the ray upon the sector to be illuminated, and the holes in the disc at the receiving station II, are preferably covered with oiled paper. The eye of the observer at *V* sees the pictures made up of the intermittent reflected light coming from *Q*. It goes without saying that for the proper accomplishment of the object, synchronous revolutions must be maintained between the discs of the two stations.



FIGS. 1 AND 2.—SEEING BY ELECTRICITY.

Herr Nipkow points out that by means of this apparatus objects in the dark can also be seen, provided they are sufficiently heated, since the lamp-black drum responds also to the non-visible rays of the spectrum. The apparatus, in addition, allows of the taking of photographs of the object so that it can be reproduced at any time. For this purpose the reflected ray from the telephone is allowed to fall upon a photographic registering apparatus, instead of the disc *S*. The developed photographic plate can then be used to illuminate the disc.

We would also draw attention to the interesting fact that if, instead of using telescopic currents, telephonic currents be sent, then with every tone the observer will see the same image for the same motion of the disc *S*. The same is the case when the disc intercepts the light from a photophone. It would therefore be within the bounds of reason to suppose that, with long practice, a person might be able to recognize in these images tones, sounds, and even words, the more so as they can be photographed and thus committed to memory. In such a case we might literally speak of "word pictures" and of the "photography of tones."

Electricity for Street Cars.

The following is a rough estimate furnished by the Van Depoele Company for comparison of expense of running street cars by electricity and horses. Of course, the figures will vary somewhat, according to location and circumstances:

ESTIMATE FOR ELECTRICAL PLANT TO RUN FIFTY CARS FOR STREET RAILWAY, SIXTEEN HOURS PER DAY.

One 250 h. p. engine	$4,500
Three 100 h. p. boilers	2,700
Foundations, setting, and connections, heater and pumps	2,500
Electric generators	14,400
Van Depoele motors	20,000
Station house	5,000
Electric conductors, etc	10,000
	$59,100

COST OF RUNNING PER DAY OF SIXTEEN HOURS.

Coal	$20.00
Engineer	6.00
Firemen	4.00
Machine man	4.00
Oil, waste, etc	2.50
Interest and depreciation, 6 per cent. interest and 10 per cent. depreciation	32.00
	$68.50

COST OF RUNNING EACH CAR PER DAY.

16 hours	$1.37

ESTIMATE OF PLANT TO RUN FIFTY CARS WITH HORSES, SIXTEEN HOURS PER DAY.

425 horses at $125 each	$53,125
100 Sets harness	500
Stable for horses	20,000
	$73,625

COST OF RUNNING FIFTY CARS PER DAY WITH HORSES.

Feed for 425 horses at 45c	$191.25
25 Stablemen at $1.50	37.50
12 other stable employés at $1.50	18.00
Horseshoeing	21.00
Veterinary surgeon and medicine	2.00
Interest on capital, 6 per cent., and 15 per cent. depreciation on horses	34.00
Total	$303.75
Cost of running each car per day	$6.07

Expense of conductors and drivers not figured, as it is presumed they would be the same in each case; but in case trains of two or more cars are run it would be less. In case trains of two or more cars are run, more work can be done with less time between runs than with horses and single cars.

These figures are deserving of the attention of street car managers.

The Attack on Bell's Patent.

Monday, November 9, was set down for the hearing of the telephone cases before the Secretary of the Interior, and the large room of the Assistant Attorney-General of the Interior Department was crowded with counsel and persons interested in these cases. Secretary Lamar opened the proceedings by stating that nine petitions had been filed in this case. Inasmuch as there seemed to be a concurrence of sentiment and wish by all the parties concerned in this controversy that the whole case should be taken up at once and considered as a whole, he (Secretary Lamar) preferred that there should be no discussion, primarily, on the question of the power of the Government to institute a suit to vacate a patent, and that the respective applicants who are movers in this matter should begin with their evidence and submit their cases.

Mr. Humphreys, attorney for the Globe Company, then proceeded to read the petitions filed in its behalf, and presented the affidavits of Zenas Wilbur, A. K. Eaton, S. S. Pratt and A. E. Dolbear, all rehearsing statements with which the electrical public is familiar. Mr. Beckwith, representing the Globe Company, read the affidavit of Antonio Meucci, describing his inventions, and exhibits were laid before the secretary to support his allegation. Meucci recounts his struggles against extreme poverty, which he says prevented him from taking out a patent for a telephone conceived by him in 1849 while in Havana, and for which he had made a caveat in 1871. A long transcription from his notes of experiments in telephony antedating the Bell patents was read, and a number of corroborative affidavits were submitted, closing the case for the Globe and Washington companies, and the case was adjourned for the day.

Improvements in the Synchronous Multiplex Telegraph System.

It is now nearly two years since we described an ingenious system to increase the transmitting capacity of telegraph wires, which had been developed by Messrs. P. B. Delany and E. A. Calahan, of this city. Since that time the system has been put into practical working between Boston and Providence and New York and Philadelphia; and soon Baltimore and New York will be connected in the same way. In the issue above referred to, that of December 29, 1883, we illustrated the methods employed at that time, but the results of experience have brought about changes which, while leaving the general principle intact, have led to a modification of detail that increases the efficiency considerably.

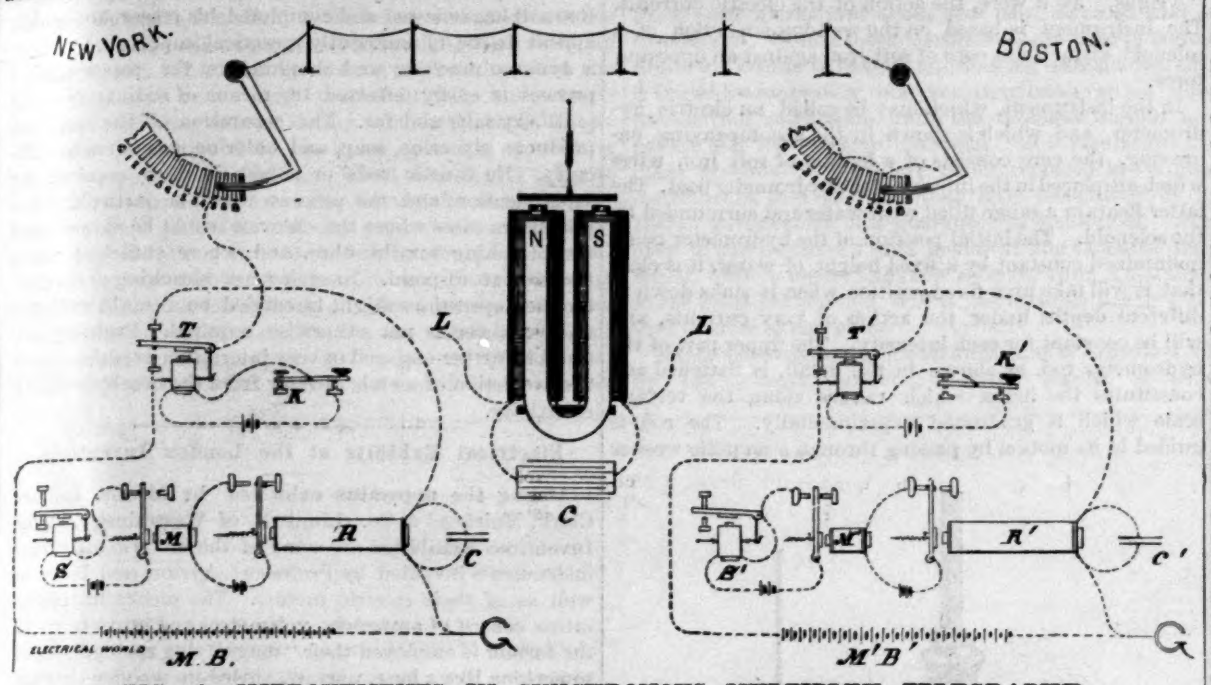


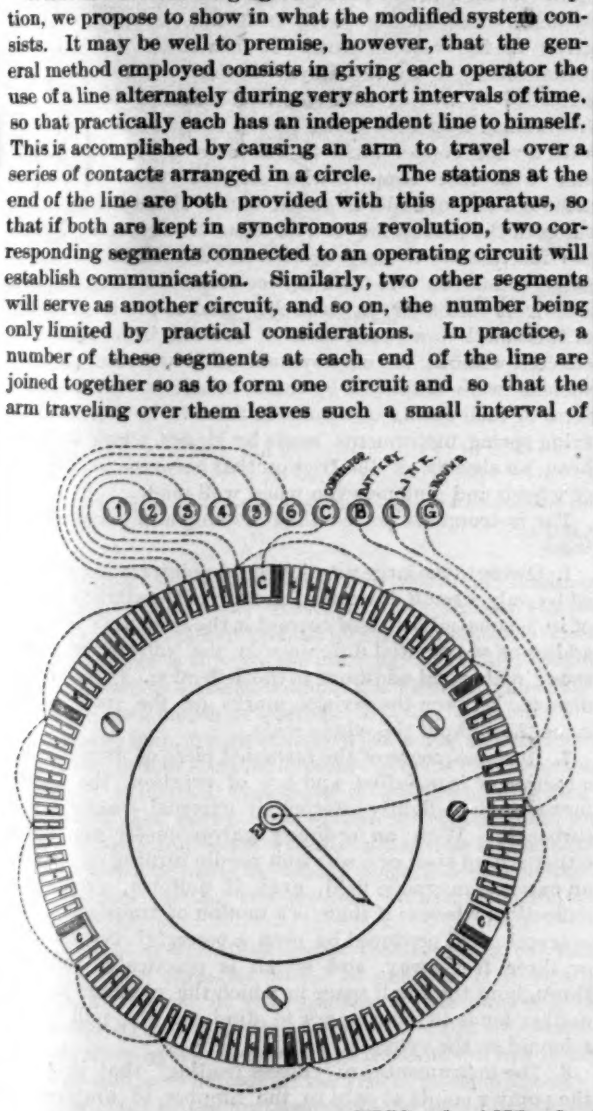
FIG. 1.—IMPROVEMENTS IN SYNCHRONOUS MULTIPLEX TELEGRAPHY.

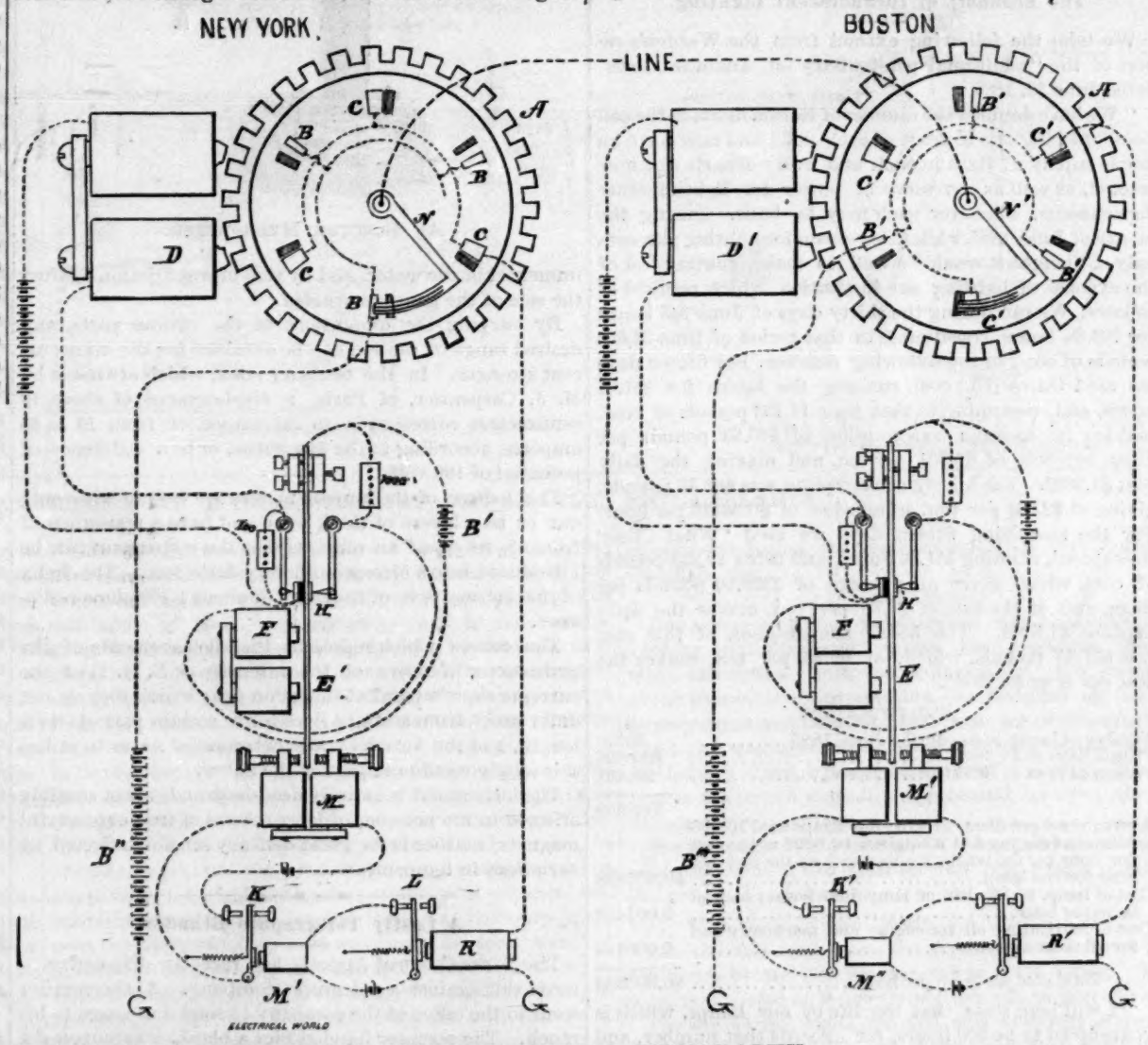
Without here entering again into an extended description, we propose to show in what the modified system consists. It may be well to premise, however, that the general method employed consists in giving each operator the use of a line alternately during very short intervals of time, so that practically each has an independent line to himself. This is accomplished by causing an arm to travel over a series of contacts arranged in a circle. The stations at the end of the line are both provided with this apparatus, so that if both are kept in synchronous revolution, two corresponding segments connected to an operating circuit will establish communication. Similarly, two other segments will serve as another circuit, and so on, the number being only limited by practical considerations. In practice, a number of these segments at each end of the line are joined together so as to form one circuit and so that the arm traveling over them leaves such a small interval of time between the successive contacts as to give practically a continuous circuit.

This is clearly shown in Fig. 1, which represents the latest improved disposition of the apparatus. The system is worked as a sextuplex, there being alternate series of six segments each. The same numbers of each series are connected together as illustrated in Fig. 1, where the No. 5 of each is so shown. From the figure it will be seen that if the arms at each station are kept in perfect unison, the operators connected with the No. 5's will have a line as well as those connected with the other segments, 1, 2, 3, 4 and 6.

The dial and segments are shown enlarged in Fig. 2. For the sake of clearness the 1's alone are shown connected, it being understood, of course, that the others are similarly joined. There are 12 series of 6 segments each, making 72 for the operating circuits, but there are 12 others, of which 6 are dead or unconnected, which are shown cross-sectioned in Figs. 2 and 3; and to these are added 6 for correcting and synchronizing the motions of the wheels at each station, making in all 84 segments. The correcting segments are marked *C* and *B* respectively in Figs. 2 and 3, and their function will be described presently.

At both stations, which we will call New York and Boston respectively, there are placed two identical sets of apparatus as shown in Fig. 3. The latter indicates, in a very clear manner, the method of synchronizing the rotation of the wheels. Taking the New York end, it will be seen that the iron cog-wheel *A* rotates before electro-magnet *D*, the circuit of which is continuously broken so as to attract the successive teeth of the wheel, and allow them to pass after reaching the median line. The circuit is broken by the reed *E*, which is kept in vibration in the same manner as a vibrating bell by the electro-magnet *F* and battery *B'*, the contact being broken at the point *H*. On the opposite side of the same point is situated the break contact of the motor wheels, above described; it will also be noted that high resistances are shunted around these two points to prevent sparking. The end of the reed *E* vibrates between the extended poles of an electro-magnet *M* with extended pole-pieces, and the battery circuit of which is normally open at *K*, being maintained so by the electro-magnet *M'*, the battery circuit of which is normally closed at *L*, the back stop of the relay *R*.





FIGS. 2 AND 3.—IMPROVEMENTS IN SYNCHRONOUS MULTIPLEX TELEGRAPHY.

Returning now to the segment wheel, we come to the method employed of maintaining the synchronism of the wheels. It will be noted in Fig. 3 that the two wheels are revolved in positions differing one-sixth of a revolution. In each wheel there are three segments, marked *B* and *B'*, which are connected together and to batteries *B''* and *B'''* respectively. There are also three segments in each, marked *C* and *C'*, connected with the relays *R* and *R'* respectively, as shown. Besides these six segments there are placed six "dead" ones, as they are called, since they are not connected to the circuit in any way. Now, as long as the wheels revolve uniformly, as indicated in their positions in Fig. 3, the circuit will be broken at that point in the revolution, as the arm in Boston is upon a dead segment, and hence no correcting impulse will be sent over the line. But if the Boston wheel should increase its speed so as to touch *C'*, while New York is still at *B*, a circuit would be formed and the following would take place: The New York battery *B''* would send an impulse through *B* and the arm *N* over the line to the Boston segment *C'*, and thence through the relay *R'*. The latter would attract its armature, open the circuit of *M'''*, and allow the spring to withdraw its armature *K'*, and thus energize the electro-magnet *M'*. The end of the reed *E* at Boston now vibrates in a magnetic field, which acts as a drag upon it and diminishes its rate. This changes the impulses in the motor magnet *D'*, which, reacting upon the wheel, changes its speed correspondingly until the arm *N'* is brought back to its correct position. When this occurs, the relay *R'* is no longer energized, its armature falls back, and everything returns to its normal state. Should the New York wheel increase its speed, the same action would take place at the end of the line, the impulse then being sent over by the Boston battery *B'''*. The drawing is so clear that we need not enter more in detail. It will be seen that six correcting impulses can be sent at each revolution of the wheel, so that a deviation in position between the two wheels of only a few thousandths of an inch (the distance between a live and dead segment), will be quickly rectified.

The arrangement of the operator's table is shown in Fig. 1, which also shows two stations connected, Boston sending and New York receiving. The system is worked on a sextuplex, there being alternate series of six segments each. The same numbers of each series are connected together as illustrated in Fig. 1, where the No. 5 of each is so shown. From the figure it will be seen that if the arms at each station are kept in perfect unison, the operators connected with the No. 5's will have a line as well as those connected with the other segments, 1, 2, 3, 4 and 6.

The dial and segments are shown enlarged in Fig. 2. For the sake of clearness the 1's alone are shown connected, it being understood, of course, that the others are similarly joined. There are 12 series of 6 segments each, making 72 for the operating circuits, but there are 12 others, of which 6 are dead or unconnected, which are shown cross-sectioned in Figs. 2 and 3; and to these are added 6 for correcting and synchronizing the motions of the wheels at each station, making in all 84 segments. The correcting segments are marked *C* and *B* respectively in Figs. 2 and 3, and their function will be described presently.

At both stations, which we will call New York and Boston respectively, there are placed two identical sets of apparatus as shown in Fig. 3. The latter indicates, in a very clear manner, the method of synchronizing the rotation of the wheels. Taking the New York end, it will be seen that the iron cog-wheel *A* rotates before electro-magnet *D*, the circuit of which is continuously broken so as to attract the successive teeth of the wheel, and allow them to pass after reaching the median line. The circuit is broken by the reed *E*, which is kept in vibration in the same manner as a vibrating bell by the electro-magnet *F* and battery *B'*, the contact being broken at the point *H*. On the opposite side of the same point is situated the break contact of the motor wheels, above described; it will also be noted that high resistances are shunted around these two points to prevent sparking. The end of the reed *E* vibrates between the extended poles of an electro-magnet *M* with extended pole-pieces, and the battery circuit of which is normally open at *K*, being maintained so by the open circuit and several interesting devices are employed. By pressing his key *K'*, the operator closes the circuit of his transmitter *T'* and sends the current from his main battery *M' B'* over the line. It passes through the transmitter lever *T* at New York, and thence to the relay *R* to ground. The relay being energized, it opens the circuit of the electro-magnet *M*, and closes that of the sounder *S*; thus the dots and dashes transmitted at Boston are received by the sounder at New York. It will be noted that when the keys at the stations are on their back-stops, as shown at New York *K*, they open the transmitter circuit, so that the line current goes to the relay.

We must also draw attention to the device employed for

the purpose of making the relays sluggish. This becomes necessary when we consider that though practically continuous for Morse work, the circuit is constantly broken, and if the relay were to follow similarly each of these makes and breaks between the successive segments of the dial plate, transmission would be impossible. In order, therefore, to make the relay respond to makes and breaks of the operator's key only, the device shown in the centre of Fig. 1 is employed. It consists in adding to the relay at each end a condenser *C* and also a permanent horse-shoe magnet, *N S*, which is laid over the coils. The cores are thus slightly polarized in the same sense as the magnet and the current coming over the line is sent so as to increase this polarity. At the same time, the current charges the condenser at every make of the contact at the key. Now, at the break, the self-induction of the relay coils would generate a current in opposite direction to the main current, and would tend to reverse the polarity of the cores and release its armature; but at the same instant the condenser is discharged, and sends in a current against the induced current of the coils, thus neutralizing it, so that the armature of the relay is held, and has hardly left its front contact before the next segment of the dial is reached, and it is again attracted before it can get to its back-stop. Consequently, no impulse is sent over the line until the key is depressed, which gives the armature time to reach its back-stop.

In order to get rid, as far as possible, of the static charge of the line, the segments, as shown in Fig. 2, are placed between the cogs on a plate which is connected to the ground. Thus, after each successive contact, the line is discharged to ground, which removes trouble from the source stated.

As six series of segments are collected and led to as many operating tables, it is evident that, with the system, six pairs of corresponding operators have practically continuous lines to themselves, and can send and break entirely independent of one another.

In the system as formerly worked, tuning forks were used in the place of reeds, and polarized relays were employed, but these are now done away with. The original inventors, in connection with Mr. R. G. Brown, have succeeded in simplifying it, so that it conforms now with ordinary Morse as it is used in this country.

The Economy of Incandescent Lighting.

We take the following extract from the Warden's report of the "additional penitentiary" at Anamosa, Iowa, dated June 30, 1885:

"We have doubled the number of Edison lights in the cell house, placing one in front of each cell; and now have an ample supply of light in each and every department now erected, as well as a reserve of power for lighting other departments, whenever such may be built. During the month of June, 1885, while using steam for lighting purposes only, I thought it would be well to make another test of the expense of lighting our institution, which resulted as follows: We ran during the thirty days of June 345 lamps for 703.33 hours, consuming in that period of time 34,686 pounds of coal, in the following manner: For fifteen days we used Galva (Ill.) coal, running the lamps for 351.66 hours, and consuming in that time 14,753 pounds of coal, making an average consumption of 983.53 pounds per diem, at a cost of $2.82½ per ton, and making the daily cost $1.3892. The hourly consumption was 482.45 pounds, giving at $2.82½ per ton, an expense of $0.63146 per hour. For the remaining fifteen days we used 'What Cheer' (Iowa) coal, running 351.66 hours, and using 19,933 pounds of coal, which gives an average of 1328.86 pounds per diem, and at the rate of $2.35 per ton, makes the daily expense $1.5164. The hourly consumption of this coal was 651.85 pounds, which, at $2.35 per ton, makes the cost per hour $0.76592.

RECAPITULATION.

Number of lamps in use during June, 1885	345
Fifteen days at $1.3892	$20.838
Fifteen days at $1.5614	23.421
	$44.259
Average cost per diem, $1.475; 345 lamps used 703.33 hours and costing $44.259, gives $0.6292 as the cost per hour for the whole number and as the cost per hour for one lamp	$0.001823
Cost of lamp, $0.85; life of lamp, 600 hours; cost of lamp per hour	0.001416
Cost of lubricating oil for engine and machinery and for all other expenses	0.000144
Total cost per lamp per hour	$0.003383

"I will here state that the life of our lamps, which is guaranteed to be 600 hours, far exceeds that number, and in one instance a lamp burned for 3,215 hours, while a large number have burned for more than 2,000 hours. During last month they averaged over 1,200 hours apiece, thus effecting a reduction of 50 per cent. on original price of lamp.

"The recapitulation of these figures shows that after operating 345 16 c. p. lamps for 703.33 hours, the net cost of producing the light of one lamp one hour was .003383, or a total amount, including interest on investment and depreciation on plant, of $845.83 for furnishing 345 16 c. p. lamps for 703.33 hours.

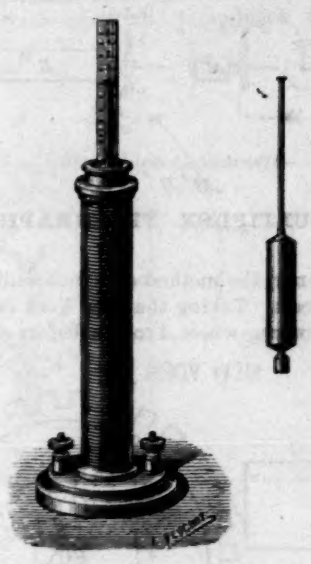
"Assuming each 16 c. p. lamp to equal in illuminating power a gas jet consuming 5 feet of gas per hour, we have 1,213,244.25 cubic feet, showing that the gas would have to be produced for 70 cents per thousand feet.

"It must be borne in mind that this is for only 345—16 c. p. lamps, and that the ratio cost of production decreases as the quantity of lamps increases."

A New Apparatus for Measuring Electric Currents.

The many new forms of galvanometers which we note constantly are as a rule designed to remedy the defects and irregularities inherent in instruments in which permanent magnets are employed as the opposing force to the directive action of the electric current. Recently M. F. de Lalande presented to the French Academy a note describing a new form of ampère and volt-meter, which is similar in principle to the electro-magnetic balance of Becquerel in that it "weighs," as it were, the action of the electric currents. The instrument is based on the well-known action of a solenoid attracting a core of soft iron against an opposing force.

In the instrument, which may be called an electric hydrometer, and which is shown in the accompanying engraving, the core consists of a bundle of soft iron wires which are placed in the interior of the hydrometer float. The latter floats in a gauge filled with water and surrounded by the solenoid. The initial position of the hydrometer being maintained constant by a fixed height of water, it is clear that it will take up a fixed position when it sinks down to different depths under the action of vary currents, and will be constant for each intensity. The upper part of the hydrometer rod, as shown in the detail, is flattened and constitutes the index which ranges along the vertical scale which is graduated experimentally. The rod is guided in its motion by passing through a metallic washer



AN ELECTRIC HYDROMETER.

immersed in the water, and by this means friction against the side of the gauge is avoided.

By varying the dimensions of the various parts, any desired range of motion can be obtained for the same current strength. In the ordinary sizes, which are made by M. J. Carpentier, of Paris, a displacement of about 10 centimetres corresponds to intensities of from 10 to 25 ampères, according to the apparatus, or to a difference of potential of 100 volts.

The helices of the ampère meters are wound with only one or two layers of thick wire, and have a resistance of from $\frac{3}{1000}$ to $\frac{3}{100}$ of an ohm, so that the instrument can be introduced into a circuit with very little loss. The helix of the voltmetre is of fine wire of about 1,700 ohms resistance.

The curves which represent the displacements of the hydrometer in terms of the intensity or E. M. F. of the currents show a point of inflection near which they do not differ much from straight lines for a certain part of their length, and the variables are determined so as to utilize this nearly rectilinear part of the curve.

The instrument is entirely dead-beat and is not sensibly affected in the presence of large masses of iron or powerful magnets; neither is its great delicacy sensibly affected by variations in temperature.

A Costly Telegraphic Blunder.

The Texas Court of Appeals has recently disposed of a novel suit against a telegraph company. A sheep-raiser went to the office of the company to send a message to his ranch. The operator handed him a blank, whereupon the Texan, remarking that he knew "nothing of the business," and had never written a "message in his life," asked the operator to write it. He dictated thus: "Meet me with two horses and Shep." "Shep" was the name of his dog. The operator wrote: "Meet me with two horses and sheep." He showed it to the sender, who, evidently being as little familiar with spelling as he was with writing, pronounced it satisfactory.

When the Texan reached the specified place he was met, much to his surprise, by his men with a drove of 2,500 sheep. The sheep had been driven a long distance through the wintry weather. Many of them had died, and others had suffered seriously from exposure. The owner sued the company for damages, and won his case in the courts. The Court of Appeals holds that the company is not liable for the consequences of the error in the dispatch. It says that in writing the message at the request of the sender the operator acted as the agent of the sender and not of the company. "True, he was the agent of the company to receive and forward messages, but not to write them for others."

Saponification by Electricity.

In 1882 Professor Rotondi presented to the Academy of Sciences in Turin a communication in which he recommended for commercial purposes the use of electricity for the decomposition of concentrated salt solution into caustic soda and chlorine gas. The experiments were confirmed by MM. Raudin and Bidet, and recently Professor Rotondi has renewed and completed his researches, which appear to be of eminently practical importance. With a dynamo machine and diaphragms, the saponification process is easily effected by means of sodium chloride (ordinary salt) and fat. The separation of the resultant products, glycerine, soap, and chlorine gas offers no difficulty. No caustic soda or potash is thus required for saponification, and the process would be particularly applicable in cases where the chlorine could be at once used for bleaching textile fibre, and where sufficient water power is at disposal. In such work bleaching and saponification operations might be carried on at night while the motive power is not otherwise required. Professor Rotondi is further engaged in very interesting experiments on the extraction of metals directly from the ores by means of electricity.

Electrical Exhibits at the London Inventions.

Among the apparatus exhibited by Messrs. Latimer Clark, Muirhead & Co. (Limited), of Westminster, at the Inventions Exhibition are some of the electric measuring instruments invented by Professors Ayrton and Perry, as well as of their electric motors. The measuring instruments consist of ammeters, voltmeters and ergmeters In the former is employed their "magnifying spring," shaped something like a long, narrow, curled-up wooden shaving, and having the property that if one of the ends be fixed while the other is pulled so as to stretch the spring, the latter end rotates through a large angle. This peculiar behavior, which of course does not occur with ordinary spiral springs, arises partly from the way in which the spring is coiled up, and partly from the special dimensions given to the various parts. It formed the subject of a communication to the Royal Society. The spring is stretched by a very thin soft iron cylinder (to which *its* free end is attached) being pulled into a solenoid wound with a wide copper strip in the case of the ammeters, and with fine copper wire in the voltmeters, and although the cylinder is pulled but a short distance into the coil, the pointer moves over some 270 degrees. Hence the instrument is very sensitive. For example, a 20-ampère ammeter will read to one-tenth of an ampère, and a 200 volt voltmeter to one volt. And as the magnifying of this small downward suck of the thin iron cylinder is effected without the employment of wheels and pinions, such as were employed by these inventors in the earlier form of their spring instruments, there is, in these magnifying spring instruments made by Messrs. Clark & Muirhead, an absence of the friction that accompanies the use of wheels and pinions, even when well made.

The instruments possess the following additional advantages:

1. Owing to the large rotation of the pointer being produced by only a *small* downward motion of the attracted piece of iron, equal additions of current in the ammeters or equal additions of potential difference in the voltmeters correspond with equal additions to the deflection. Therefore the distance between the division marks on the scale is the same throughout the whole scale.

2. In consequence of the attracted piece of iron having a motion of *translation*, and not of *rotation*, the instruments are but slightly affected by external magnetic disturbance. With an ordinary galvanometer employing either a hard steel or a soft iron needle turning on a pivot, an external magnetic field, even if uniform, produces a deflection, whereas if there is a motion of translation, the magnetic field produced by even a powerful dynamo two or three feet away, and which is practically uniform throughout the small space in which the cylinder moves, neither tends to increase nor to diminish the pull of the solenoid on the cylinder.

3. The instruments are "direct reading;" that is to say, the pointer points at once to the number of ampères, or volts, being measured, and no constant nor table of values need be employed.

4. The ammeters and voltmeters can be used to measure currents passing through them in either direction, as can be done by an electro-dynamometer; but unlike the dynamometer, the magnifying spring instruments have (in addition to the main pointer which tells the number of ampères or volts) a small compass needle in the base, which indicates the direction in which the current is flowing, which is, of course, equally important to be known when accumulators are being used.

Professors Ayrton and Perry's ergmeter measures the total amount of electric energy that has been given to a house, or to a room, during the previous week or month, and not merely the number of coulombs, etc.; that is to say,

the ergmeter takes account of variations in the potential difference maintained between the mains as well as in the current supplied to the room or building, and it is, of course, the products of the potential difference into the current into the time, or simply the total quantity of electric energy supplied that the householder ought to pay for, and not simply the number of coulombs of electricity. The ergmeter can be very conveniently employed in the measurement of the efficiency of accumulators, since the variations in the electromotive forces of the accumulators during charging and discharging, which, of course, is taken into account by the ergmeter in its indications, must not be neglected in determining the efficiency of accumulators. The instrument consists of a fairly good-going clock, the pendulum of which consists of a coil of fine wire, which is a shunt to the house, swinging between two stationary coils of copper strip through which the main current flows. And the retardation of the clock, as the inventors have shown both mathematically and experimentally by observations lasting over many months, are *directly* proportioned to the total quantity of electric energy supplied to the house. When the house is using no electric power, as, for example, during the day, the ergmeter should go like an ordinary good clock, so that its accuracy can at any time be tested by the user by comparing its rate of going, when no electric power is being used in the house for lighting or other purposes, with that of any decent watch or clock. On the other hand, when electric power is being used in the house, the ergmeter loses, and the ergmeters are now so wound that a loss of one minute corresponds with one Board of Trade unit supplied to the house. Hence the user, or the electrical inspector, has merely to multiply the number of minutes the ergmeter is slow by the price agreed on for a Board of Trade unit, to settle how much the electric bill should be for the past month or quarter.

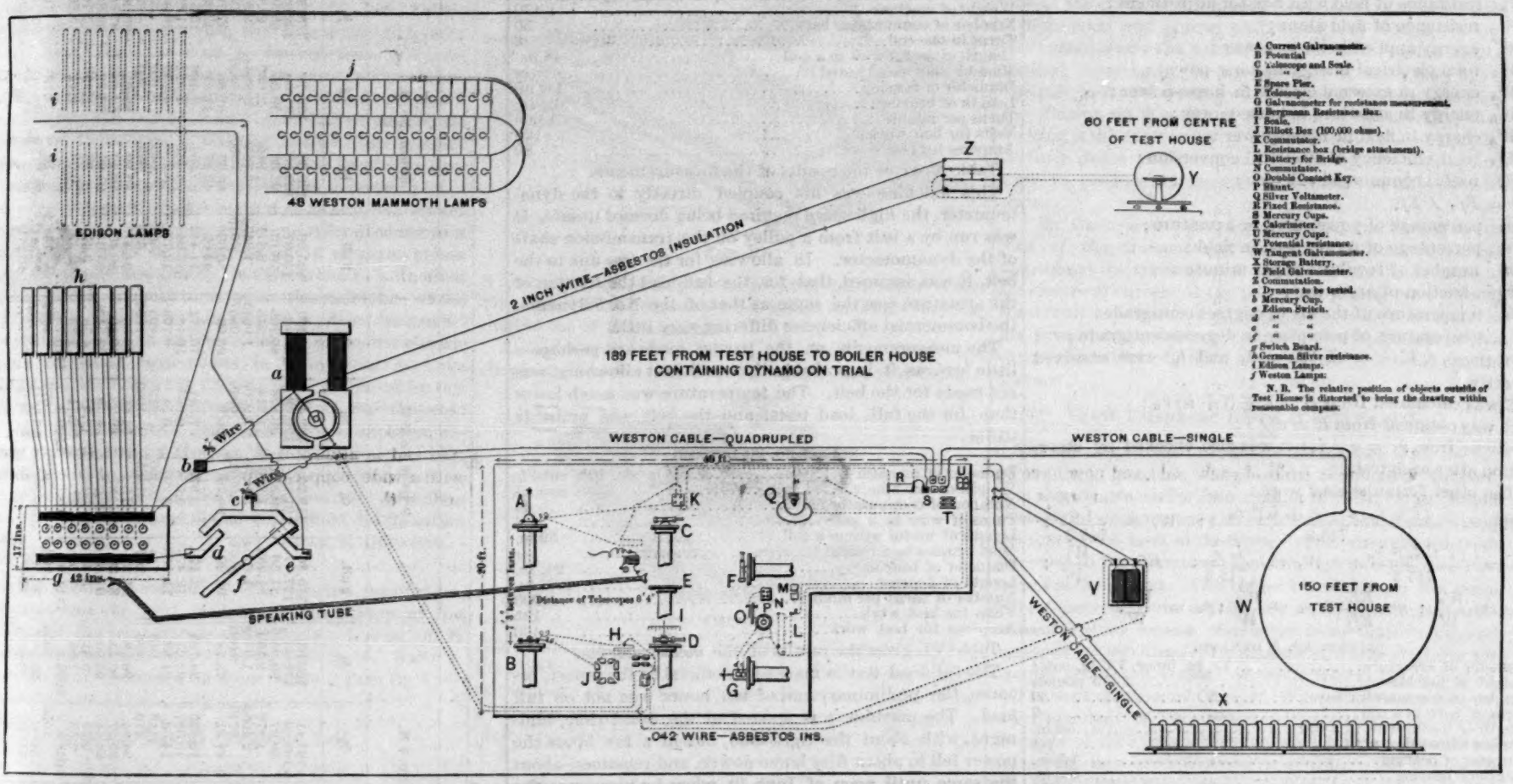
It does, then, for electricity what a gas meter does for gas, but it does something more—it takes into account, as already explained, variations in the pressure, which no ordinary gas meter does except to the consumer's disadvantage; and hence a similar unfairness in the electric bills cannot be made as is made in the gas bills by the gas companies varying the pressure without reference to the consumers.

It might at first sight appear that errors in the indication of the ergmeter would be produced if it were used near a dynamo, in consequence of the magnetic field created by the magnets of a dynamo, but this is not the case, since as the motion of the pendulum is one of translation and not of rotation, the rate of going of the clock is not affected by the uniform magnetic field that a dynamo produces a few feet away. Indeed, by a recent addition the inventors have made it impossible for a dishonest user to produce faulty indications by putting a powerful magnet even close to the ergmeter.

In both the voltmeter and in the ergmeter there is a coil of fine wire of high resistance, and Professors Ayrton and Perry have carefully considered, in a paper recently read before the Physical Society, how much of this coil should consist of copper and how much of German silver wire, so that the error due to the heating produced by a long passage of the current through the fine wire should be a minimum.

The firm are also exhibiting Winter's Patent Block Instruments, manufactured by them, the advantages of which are as follows: Neither of the instruments can be put to "Clear" or "Danger" without the independent action of both signalmen. Should the plunger at either station be depressed by accident, it only strengthens the power which holds the indicator over to the last position. The indicators are actuated entirely by local batteries, so that they can not be reversed even temporarily by lightning; and as the only portion in the line circuit is a sensitive automatic switch, the instrument will work efficiently the longest distances. Should the case be removed and the indicator moved by a malicious person, they will return immediately to their former position. When used on single line sections, they clearly show in which direction the train is passing, and *it is impossible to give permission for a train to come in the opposite direction until the arrival of the first train has been signaled and acknowledged.* When these instruments are used in connection with Winter & Craik's interlocking semaphores there is the additional safety that the signalman cannot lower his starting semaphore until the requisite signals have passed and "Line clear" obtained. It is significant that other systems in India are being replaced by Winter's instruments, and the fact that it is recognized by the Indian government is a guarantee of its merits. Moreover, it was awarded a gold medal at the Calcutta Exhibition, while a report has been received from Australia as to the great satisfaction which the system has given in that quarter of the globe.

Mance's submarine telegraph apparatus is exhibited, and the testing apparatus of Sir Henry Mance, of which the firm are the sole manufactures. There are some beautiful specimens of the other classes of apparatus which the firm manufacture, and which are a good indication of the excellence of their workmanship, such as condensers, galvanometers, resistance boxes, Saunder's submarine telegraph key, and other keys; Latimer Clark's standard element; batteries, insulators, and other submarine and land telegraph apparatus. Some excellent and tasteful specimens of the various classes of covered wires now in use in the market for electric lighting, telegraph, telephone, electric bells, and other purposes. Blackburn's portable testing apparatus, which has been specially designed for the use of electric light engineers, is exhibited; as also, in another part of the building, is Liveing's patent gas indicator, for indicating the percentage of gas in mines, which is manufactured by the firm. In the open yard, near the compressed air tramway, may be seen some of Muirhead's compound iron telegraph poles fitted with insulators complete, which are well known for their strength and adaptability for telegraph purposes, and the great feature in which is their lightness, the importance of which as regards transport over rough country is well known to practical telegraph engineers.



ARRANGEMENT OF DYNAMO-TESTING APPARATUS, PHILADELPHIA.

Report of Dynamo Tests Made by the Franklin Institute.

Immediately succeeding the conclusion of the life test of incandescent lamps, the results of which we gave in our issue of Aug. 29, the committee of the Franklin Institute proceeded with the tests of dynamo-electric machines. The companies that entered their machines for this test were the Edison Electric Light Company and the United States Electric Lighting Company.

While we leave for a succeeding issue the interesting methods employed in the test, in order to obtain great accuracy, we give to-day the results which are embodied in the accompanying tables.

The general arrangement of the apparatus used is shown in the accompanying diagram. The test room, in which most of the instruments for electrical measurement were placed, was in about the middle of the exhibition building of the Franklin Institute. The dynamos, with the boiler and engine used in running them, were in a shed at one corner of the building; and the resistances for their external circuit—lamps and German silver strips—in a room inside the building and very near the shed.

The storage battery, tangent galvanometer for current calibrations, and galvanometer for measuring field currents, were in different parts of the building, far enough from the test room not to affect the instruments in it.

The leads from the dynamos and storage battery, and to the tangent galvanometer were of heavy, insulated copper cable. They were taken to the corner of the test house farthest from the instruments, and where they approached it the two parts of a circuit were twisted together, one of them being covered with rubber tubing as an additional precaution against leakage. Even with the heaviest currents (about 400 ampères) there was no effect on the instruments, and calibrations made both when the dynamos were and were not running, showed that any disturbance from currents in the leads had been avoided.

Before any measurements were made, the insulation resistances between the leads themselves, and from the leads to the ground, were carefully tested and found in every case to be over fifty megohms; and measurements at intervals during the tests showed that they remained about the same.

OBSERVATIONS.

The power applied to the dynamos was measured by a Tatham dynamometer, while the electrical energy was calculated from observations of the potential at the terminals of the machine, the currents in the external circuit and field, and the resistance of the armature. The latter was measured by sending a current from a storage battery through the armature and observing the current in the circuit and fall of potential between the terminals of the machine.

The dynamos were run both on lamps and dead resistance, the value of the latter serving as a rough check on the potential and current.

TESTS.

For the full load tests, the machines were run at least ten hours before any measurements were made. They were then tested at intervals of from one to two hours.

For the partial loads, the dynamos were run on quarter load for two or three hours, then tested, then run on half load for a couple of hours, and tested, etc.

The method of making a test was as follows: A time to begin was set, and the observers got ready to start at the signal from the test house. After the signal, double readings of the potential and current galvanometers were simultaneously made each minute, and the scale beam and number of revolutions of the dynamometer observed. The field galvanometer was reversed, and read as often as possibly, usually four or five double readings.

At the end of ten minutes, a signal to stop was made; the dynamo was stopped, the field circuit broken, the storage battery put on, and the armature resistance measured. The brushes were then lifted, and the field circuit made and its resistance measured. Finally, the

TABLE VIII.—(*Table of Efficiencies.*)

	Volts.	Ampères.	Weight.	Total Efficiencies. Full load.‡	¾ Load.	½ Load.	¼ Load.	Commercial Efficiencies. Full load.‡	¾ Load.	½ Load.	¼ Load.
Edison No. 4	125	80	1,470 lbs.	94.45	93.26	89.65	83.89	88.44	87.40	83.65	76.40
Edison No. 5*	125	100	2,475 "	96.01	.....	.....	.....	89.19	.....	.....	.....
Edison No. 10.	125	200	4,710 "	94.68	92.44	90.55	83.32	89.61	88.23	86.12	77.53
Edison No. 20*	125	400	8,341 "	96.65†	95.46	92.77	88.80	91.96†	91.19	88.93	83.76
Weston 6 M.	120	80	2,000 "	94.67	96.53	94.84	89.33	87.66	90.10	89.23	82.87
Weston 7 M.	160	125	3,300 "	96.56	96.38	94.84	90.08	89.37	90.49	89.57	84.37
Weston 6 W. I.	130	100	2,100 "	96.20	94.06	92.89	91.64	90.85	89.22	87.32	84.07

* Armature insulation gave way. † Unofficial. ‡ Average of full load measurements.

constants of the current and potential galvanometers were checked on the German silver strips.

When the tests for the day were finished, the friction of the armature and of the dynamometer were obtained, and the latter subtracted from the power applied for each test.

Communication from the test house to the dynamo shed was by an electric bell, and through a speaking tube.

The following notation was used in the formulæ:

e difference of potential between terminals of dynamo;
E total electromotive force generated in armature;
i current in external circuit;
i_s current in field;
R resistance of external circuit;
r_a resistance of armature coils;
r_s resistance of field with box for adjustment;
S resistance of field alone;
W energy applied in horse-power;
W_t total electrical energy in horse-power;
W_e energy in external circuit in horse-power;
W_a energy in armature in horse-power;
W_s energy in field in horse-power;
Ef_t total efficiency of electrical conversion;
Ef_c useful commercial efficiency;
$\eta = Ef_c / Ef_t$
p_a percentage of power used in armature;
p_s percentage of power used in field;
n number of revolutions per minute;
Fric. friction of armature;
t_a temperature of the air in degrees centigrade;
t_p temperature of pole piece in degrees centigrade;

Of these, e, i, i_s, r_a S, W, n, t_a and t_p were observed directly.

E was calculated from $E = e + (i + i_s) r_a$;

R was obtained from $R = e / i$;

r_s was from $r_s = e / i_s$; it was also checked by observation after each test.

The other formulæ used were:

$$W_t = \frac{(i+i_s)\,e + (i+i_s)^2\, r_a}{745.3}\ ;\quad W_e = \frac{i\,e}{745.3}\ ;$$

$$W_a = \frac{(i+i_s)^2\, r_a}{745.3}\ ;\quad W_s = \frac{i_s\, e}{745.3}\ ;\quad Ef_t = \frac{W_t}{W}\ ;$$

$$Ef_c = \frac{W_e}{W}\ ;\ \eta = \frac{Ef_c}{Ef_t}\ ;\ p_a = \frac{W_a}{W}\ ;\ p_s = \frac{W_s}{W}.$$

EDISON NO. 5 DYNAMO.

Diameter of armature	$7\frac{1}{16}$ in. inner, $7\frac{7}{8}$ in. outer
Weight of machine	2,475 pounds
Number of commutator bars	50
Turns of wire in a coil	2
Length of useful wire in a coil	52 in.
Brushes adjusted or not?	yes
Diameter of bearing	$1\frac{5}{8}$ in.
Length of bearing	$5\frac{5}{8}$ in.
Revolutions per minute	1,400
Volts for best work	125
Ampères for best work	100

Table I. gives the result of the measurements.

This was the first machine tested, and the measurements were intended as much to show any weak points in the method as to serve as a test of the dynamo. If no trouble occurred, the work was to be accepted, otherwise it would have been repeated after the causes of error had been removed.

After the second test, the insulation of the armature gave way; making it impossible to repeat the full load measurements, or to test on the partial loads.

EDISON NO. 10 DYNAMO.

Diameter of armature	$9\frac{11}{16}$ in. inside; $10\frac{5}{8}$ in. outside
Weight of machine	4,710 pounds
Number of commutator bars	64
Turns of wire in a coil	1
Length of useful wire in a coil	33 in.
Must brushes be adjusted?	yes
Diameter of bearing	$2\frac{5}{8}$ in.
Length of bearing	$9\frac{5}{8}$ in.
Number turns per minute	1,200
Volts for best work	125
Ampères for best work	200

Table II gives the results of the measurements.

WESTON NO. 7 M. DYNAMO.

Diameter of armature	$9\frac{3}{4}$ in.
Weight of machine	3,300
Number of commutator bars	64
Total number of turns in coils	128
Turns per commutator segment	2
Average length of a turn	6 ft. 8 in.
Must brushes be adjusted?	slightly.
Diameter of bearing, pulley end	2 in.
Diameter of bearing commutator end	$1\frac{1}{8}$ in.
Length of bearing, pulley end	$7\frac{1}{4}$ in.
Length of bearing commutator end	$6\frac{1}{4}$ in.
Number of turns per minute	1,050
Volts for best work	160
Ampères for best work	125

Table III. gives the results of the measurements.

The greatest value of the commercial efficiency here is on three-quarter load, the slightly less value of the total efficiency, as compared with the full load, being more than counterbalanced by the smaller loss in the armature and field.

WESTON NO. 6 M. DYNAMO.

Diameter of armature	$8\frac{1}{2}$ in.
Weight of machine	2,000
Number of commutator bars	72
Total number of turns	144
Turns per commutator segment	2
Average length of a turn	6 ft. 5 in.
Must brushes be adjusted?	slightly
Diameter of bearing, pulley end	$1\frac{5}{8}$ in.
Diameter of bearing, commutator end	$1\frac{5}{8}$ in.
Length of bearing, pulley end	$6\frac{3}{4}$ in.
Length of bearing, commutator end	5 in.
Number of turns per minute	1,150
Volts for best work	120
Ampères for best work	80

Table IV. gives the results of the measurements.

EDISON NO. 4 DYNAMO.

Diameter of armature	$6\frac{1}{4}$ in. inside, $7\frac{1}{16}$ in. outside.
Weight of machine	1,470
Number of commutator bars	50
Turns in one coil	2
Length of useful wire in a coil	48 in.
Must brushes be adjusted?	yes
Diameter of bearing	$1\frac{1}{2}$ in.
Length of bearing	$6\frac{1}{4}$ in.
Turns per minute	1,600
Volts for best work	125
Ampères for best work	80

Table V. gives the results of the measurements.

This machine was not coupled directly to the dynamometer, the high speed required being deemed unsafe. It was run by a belt from a pulley on the transmission shaft of the dynamometer. In allowing for the loss due to the belt, it was assumed that for the full load the friction of the armature was the same as that of the No. 5 dynamo, the commercial efficiencies differing very little.

The measurements on the partial loads are perhaps a little low, as it is probable that sufficient allowance was not made for the belt. The temperature was much lower than for the full, load tests, and the belt was probably stiffer.

EDISON NO. 20 DYNAMO.

Diameter of armature	$9\frac{11}{16}$ inside, $10\frac{5}{8}$ outside
Weight of machine	8,331 pounds
Number of commutator bars	44
Turns of wire in a coil	1
Length of useful wire in a coil	59 in.
Must brushes be adjusted?	yes
Diameter of bearing	$2\frac{5}{8}$ in.
Length of bearing	$10\frac{1}{4}$ in.
Number of turns per minute	1,000
Volts for best work	125
Ampères for best work	400

Table VI. gives the results of the measurements.

The full-load test is marked unofficial in the report, because the preliminary run of ten hours was not on full load. The machine was started at the usual time, midnight, with about the right load, but in a few hours the power fell to about fifty horse-power, and remained about the same until noon of June 19, when by increasing the number of revolutions, the proper load was nearly attained. The tests were to have been repeated the next day, but unfortunately the insulation of the armature gave way, making this impossible.

The figures, as given, may nevertheless be taken as the correct performance of the machine.

WESTON NO. 6 W. I. DYNAMO.

Diameter of armature	$8\frac{1}{4}$ in.
Weight of machine	2,100 pounds
Number of commutator bars	56
Total number of turns in armature coils	112
Turns per commutator segment	2
Average length	6 ft. $3\frac{1}{2}$ in.
Must brushes be adjusted?	slightly
Diameter of bearing, pulley end	$1\frac{5}{8}$ in.
Diameter of bearing, commutator end	$1\frac{5}{8}$ in.
Length of bearing, pulley end	$6\frac{3}{4}$ in.
Length of bearing, commutator end	5 in.
Turns per minute	1,200
Volts for best work	130
Ampères for best work	100

Table VII. gives the results of the measurements.

The values of the total efficiency for the different measurements of this machine differed widely. The first test gave a much smaller value than the rest, and was rejected, because, whether the difference was caused by errors in the measurements, or in the adjustment of the machine, the test evidently did not represent the normal efficiency of the dynamo.

In the tables the external resistances are marked d and e, according to whether dead or lamp resistance was used.

Table VIII. shows the tabulated average efficiencies of the machines. In our *résumé* we have only given single readings for each load, but in the trial several were taken of each, and their average is given collectively in Table VIII.

In the table, the full-load efficiencies of the Edison No. 20 dynamo are marked "unofficial," because, as stated, the preliminary run was not in conformity with the code, not because there is any reason to mistrust the results.

Of the fifty-four measurements made, four were for

Load.	I. Edison No. 5. Full.	II. Edison No. 10. Full.	¾	½	¼	III. Weston No. 7 M. Full.	¾	½	¼	IV. Weston No. 6 M. Full.	¾	½	¼	V. Edison No. 4. Full.	¾	½	¼	VI. Edison No. 20. Full.*	¾	½	¼	VII. Weston No. 6 W. I., 130 Volts. Full.	¾	½	¼
E. M. F. at terminals	125.9	125.08	125.41	126.00	128.39	156.07	163.66	163.41	163.93	119.86	119.70	122.41	119.19	125.20	128.06	128.77	125.04	126.16	122.0	123.99	124.8	124.29	133.7		
Total E. M. F.	131.5	130.35	130.81	128.74	132.22	165.58	166.07	168.29	172.65	127.17	121.70	126.98	125.12	129.97	130.40	131.09	129.60	127.46	124.10	127.55	129.89	126.34	137.19		
Current in ext. circ.	100.92	201.48	52.07	107.05	39.55	125.78	33.20	66.27	89.25	71.50	20.535	39.878	60.705	76.12	1.940	3.256d	80.00	100.22	4.915	5.124	114.2	46.19	81.99		
Current in field	2.385	4.071	3.46	3.69	2.082	2.378	1.738	1.872	2.163	1.286	1.236	1.214	1.246	2.211	5.755e	2.201e	2.013	4.942	.63384	.41614	2.171	2.144	2.242		
External resistance	1.241d	.6208e	2.4094	1.177d	.5556	.5582	4.921d	2.4064	1.675d	1.675e	5.827e	3.070e	1.063d	.1647d	.0550	.0582	.0116e	.0116	.0120	.0120	.0438	1.068e	.0404	.0441	
Armature resistance	0.613	.0308	.0253	.0239	.0556	.0742	.1689	.0716	.0683	.1603	.0821	.0040	.0057	.0610	.0550	.0582	.0256	.0106	.0106	.0106	.0438	.0404	.0421	.0441	
Field, with box	52.59	31.10	36.24	34.14	22.83	65.02	24.16	87.31	75.78	57.51	60.90	57.90	95.60	56.63	66.33	61.85	57.78	25.53	24.82	24.90	57.51	60.90	57.90		
Field, alone														44.69	40.43	41.31	42.39								
Power applied	18.69	37.69	11.556	21.30	12.517	29.29	8.658	16.323	24.123	21.01	5.002	8.820	10.774	14.443	5.050	8.108	12.517	20.254	5.43	53.11	21.01	5.002	8.820	16.48	
Total elect. energy	18.53	35.67	9.449	19.13	11.67	28.47	7.798	15.387	23.25	20.29	4.695	8.193	10.40	13.64	4.237	7.322	11.67	17.985	4.695	50.71	20.29	4.695	8.193	15.50	
Ext. elect. energy	16.85	33.81	8.762	18.11	10.85	26.34	7.304	14.53	21.83	19.13	4.281	7.703	9 708	12.77	3.859	6.833	10.85	16.905	4.281	48.44	19.13	4.281	7.703	14.70	
Energy in arm	.878	1.178	.105	.582	.338	1.635	.498	.1131	.446	.714	.207	.0585	.493	.371	.1191	.1275	.129	.1858	.837	.556	.0412	.1359	.358	.394	
Energy in field	.401	.675	.582	.625	.382	.498	.382	.410	.476	.507	.1985	.1983	.1602	.501	.436	.300	.300	.837	.800	.852	.705	.364	.1359	.403	
Total efficiency	98.53	94.61	81.77	89.80	96.30	97.21	90.08	94.37	96.38	94.37	89.33	94.84	96.53	94.47	83.89	80.65	96.51	88.60	92.77	95.46	96.53	91.64	92.89	94.06	
Commercial efficiency	89.78	89.70	75.83	85.02	87.23	89.92	84.37	89.57	90.49	87.38	82.87	89.23	90.10	88.43	76.40	83.65	91.90	83.76	88.83	91.19	91.02	84.07	87.32	80.22	
Economic coefficient	92.60	94.80	92.73	94.68	94.53	92.51	93.65	94.33	93.53	94.99	91.74	94.01	93.34	93.61	91.07	93.32	95.22	94.33	95.86	95.53	94.99	91.74	94.01	94.86	
Per cent. power in arm	4.65	2.93	1.85	2.93	2.88	5.59	1.96	2.75	3.91	3.78	1.51	1.47	2.39	3.47	1.59	1.59	2.70	.96	1.57	2.66	3.78	1.51	1.47	2.39	
Per cent. power in field	2.12	1.80	5.04	2.18	2.18	1.70	4.41	2.53	1.08	1.73	6.70	4.190	2.71	2.57	6.63	4.41	3.06	4.13	1.57	1.61	1.73	6.70	4.05	2.44	
No. revolutions	1400.8	1208.6	1207.6	1207.7	1202.6	1043.5	1041.4	1038.8	1034.1	1114.9	1110.7	1109.5	1113.7	1252.3	1168.3	1167.2	1066.1	1066.9	1023.9	1066.8	1250.6	1168.3	1252.3	.13	
Friction of arm		.437	.437	.437	.437	.3115	.1956	.1956	.1956	.588	.1679	.1679	.1672												
Temp. of air	26.4° C.	26.5° C.	27.5° C.	27.5° C.	27.0° C.	30° C.	31° C.	31° C.	30.5° C.	30.5° C.	34° C.	33.5° C.	33.5° C.												
Temp. of pole-piece	44° C.	50.5° C.	35.5° C.	44.5° C.	44.0° C.	42° C.	35° C.	35° C.	36.5° C.	41.5° C.	36.7° C.	39.5° C.	39.5° C.	46.1° C.	37.2° C.	29.5° C.	35.0° C.	28.5° C.	37.8° C.	28.3° C.	30.70 C.	31° C.	37° C.		

* Unofficial.

obvious reasons deemed unworthy of calculation. These were two tests of the Edison No. 5 dynamo, and a couple of partial-load tests of the Weston No. 7 M machine, made while the constant of the potential galvanometer was unsteady. Of the remaining fifty tests, but one was rejected —a full-load measurement of the Weston 6 W. I. dynamo.

Considering the care taken in standardizing all of the instruments used in the measurements, and the very close agreement of tests made on the same dynamo, it seems probable that the results given in the above table represent very nearly the efficiencies of the machines under the conditions of the tests.

The dynamos were favored by being coupled directly to the dynamometer, and it will be seen on looking at the tables that the loss by friction was slight.

In the measurements the ohm was taken at 106 centimetres of mercury, so in order to reduce the values to absolute measure the potentials, and, therefore, the efficiencies, should be reduced by about one-fourth per cent.

The report is signed by the following: Louis Duncan, Ensign U. S. N., Johns Hopkins University, Chairman; Geo. L. Anderson, Secretary; Prof. Marks, University of Pennsylvania; Lieut. J. B. Murdock, U. S. N., and A. B. Wyckoff.

An Inquiring Mind.

To the Editor of The Electrical World:

SIR: Please inform me (1) what is the correct pronunciation of the word ohm. A friend of mine, Mr. D., says the letter *o* is given the sound of *o* in "of"; but I believe it should be pronounced giving the long sound to letter *o* as *o* in "own," since the word is derived from the name of Dr. Ohm, and being a German, his name would be pronounced with the German sound of *o*. Whose pronunciation is correct, Mr. D.'s or mine? 2. What current would be necessary to produce a heat or temperature of 2,000° in a resistance of 2,000 ohms? 3. In what proportion does the temperature increase as the current increases? 4. I have been informed that a current of 20 ampères passed through a certain resistance will develop or produce four times as much heat as a current of 10 ampères passed through the same resistance. Is this correct? 5. In what proportion does the heat increase as the resistance of the body through which a certain current is passed increases? 6. In your issue of Oct. 24 you speak of a dynamo electric machine of thirty horse-power, in your article on "An Electrical Furnace"; what current was produced by this dynamo, and what was the resistance of the carbon cores? 7. Speaking of telephone repeaters, has the repeater invented or designed by Thomas A. Edison, which really consists of a receiver and a transmitter combined, having one diaphragm common to both, ever been put to a practical test; if so, and found defective, in what did its defect consist?

CHAS. E. OLDACRE.

NOBLESVILLE, IND.

ANS.—1. You are correct. 2. The data are insufficient. 3. With no loss, the *heat* increases as the square of the current, and the temperature accordingly. 4. Yes. 5. It increases within limits directly as the resistance. 6 and 7 We are not fully informed on these points.—EDS. E. W.

Another Lowell Syndicate Suit.

The following details are given by the Lowell papers in regard to the new suit against the members of the old syndicate:

Another suit has been entered which will cause some comment in telephone circles. It has been brought by the Erie Telephone and Telegraph Company against the members of the old syndicate, William A. Ingham, Charles J. Glidden, Loren N. Downs, William H. Bent and Alonzo A. Coburn, to recover $150,000, the amount which the Erie paid for the purchase of the Southeastern Dakota Telegraph and Telephone Company and the Arkansas Telephone Company, and have expended upon these companies in the way of repairs. The reason for the suit is alleged fraud on the part of Ingham *et al.*, that they, when officers of the Erie, bought the Dakota and Arkansas companies for the Erie, paying $95,000 therefor, and turned it over for $127,000, thus receiving $32,000 more than they paid for it. This, the plaintiff company alleges, defendants had no right to do, as they were at that time officers of the Erie. The suit has been brought to have the whole transaction voided, to recover the $127,000 paid for the two companies, and also the amounts expended in repairs, etc., and thus the *ad damnum* has been placed at $150,000. This is the outcome of a plan of action decided upon by the Erie company at a meeting held in Albany, N. Y., two months ago. Last Saturday attachments were placed upon all the stock found in the Lowell banks belonging to the members of the old syndicate. The plaintiff's declarations have not yet been filed. General Butler and Wm. H. Anderson are counsel for the plaintiff; D. S. & G. F. Richardson for defendants.

The suit which was brought against the syndicate last May by James W. Bennett, Frederick W. Sherman and Henry W. Tibbetts, for alleged misrepresentations by the syndicate, whereby these gentlemen were induced to invest largely in the Erie company, is now on the court docket, not being reached during the last term, but will probably be tried in December at Cambridge.

The Cyclostyle—A New Duplicating Apparatus.

We have lately noticed in the offices of electrical companies a very useful and ingenious apparatus known as the cyclostyle. It is somewhat singular, we think, that, so far, no perfectly satisfactory means have been found for applying electricity in this work, but the fact remains, as the field of employment for the well-known electric pen has never been anything but limited; while the cyclostyle, depending on a mechanical device very similar to that used in the electric pen, has already, in a very short time, won marked and widespread popularity. The Metropolitan Telephone and Telegraph Company has had one of the cyclostyles in use nearly twelve months, in which time it has more than paid its cost, without perceptible wear. The United States Signal Service is also making very extensive use of the machine.

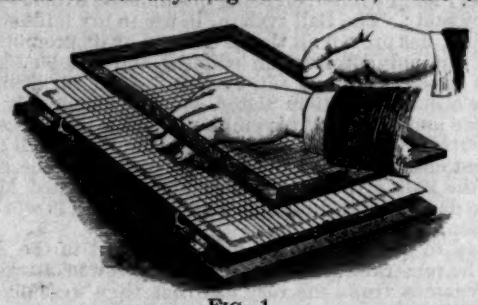


FIG. 1.

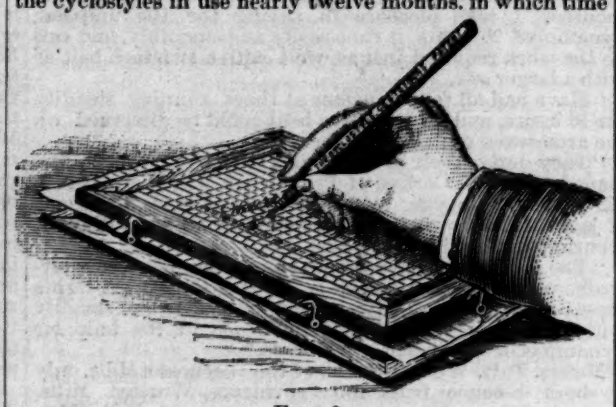


FIG. 2.

A few words will suffice to describe this useful but simple apparatus. On a plain walnut board is fixed a zinc writing tablet, and a double frame, of walnut too, fits closely around the zinc, the under frame being hingde to the board at one side. When the upper frame is removed for the purpose, a sheet of thin prepared paper is placed on the tablet, Fig. 1. Then, as seen in Fig. 2, the frame is replaced and locked to the underneath one. The paper is thus fastened securely in the frame, as it would be in an ordinary drawing board. At this stage the apparatus is ready for use. The cyclostyle pen consists of a tiny wheel made of an alloy of iridium and palladium, and has sharp cutting edges on its circumference. The wheel is pivoted to a steel bar attached to a wooden handle. The pen is used as though it were of the ordinary form—see Fig. 2—except that a little heavier pressure is required. In passing over the surface of the waxed paper the little wheel revolves with great rapidity, and turns in the direction of the writing, with the result that a number of extremely minute perforations are made in the sheet, so closely following each other that without looking narrowly at it the line of tracing seems to be continuous. As soon as the writing is done, a piece of ordinary writing paper, unglazed if possible, is put under the waxed paper and on the zinc tablet. Over the waxed paper an inking roller is passed, as in Fig. 3, a quickly drying printer's ink being used. The frame is now lifted, and on the sheet underneath a clear and exact reproduction is found, as in Figs. 4 and 5.

FIG. 3.

FIG. 4.

These few words are a facsimile of work produced by this process.

FIG. 5.

The copy obtained in this way has a decided advantage in being in black ink, which gives it practically the appearance of an autograph letter. The operations necessary can be done in less time than is taken to describe them, while as many as 2,000 copies can be pulled from the one original, at a rate of from 400 to 500 an hour. The Cyclostyle Company, at their office, 152 Broadway, show a large and most interesting variety of work executed with the apparatus.

Another Telephone.

A non-technical contemporary gives an account of a new telephone invented by Mr. J. T. Guthrie, of Leesburg, O., and for which wonderful things are claimed. The following rosy description, which is rather lacking in clearness, is given:

"The instrument is an electric telephone, operated by a direct current of electricity, and not by induced currents as are other telephones, thus doing away with the induction coil so commonly used. The articulation of speech is made by a natural and mechanical disturbance of the electric current at the positive and negative poles, which are brought near to or in contact with the diaphragm. One pole is made of a close and compact natural production of the earth, and is a good conductor; the other pole is of an open and porous nature and not a good conductor; consequently the natural and unnatural poles make a natural disturbance in the passage of electricity from one pole to the other, and when words are spoken against the diaphragm it makes a mechanical disturbance, thus making it the most sensitive transmitter in the world. Mr. Guthrie defies the telephone fraternity of this day and time to produce as sensitive a transmitter as is his telephone.

"Mr. Guthrie also desires all scientific men to give his idea of the transmission of speech a thought. In his instrument the transmission is made by the disturbance of the electrical current at the poles by opening and closing the circuit (as is the case in telegraphy), which is done in his system by speaking against the diaphragm, which causes the current to open and close at every word spoken thereon."

New Telephone Office at Ottawa, Ill.

The transfer of the telephone central office from the old to the new quarters was recently completed. Ottawa, says the Ottawa *Daily Times*, can now boast of as perfect a telephone exchange as can be found in the country, and the first of the kind in the State. The wires are led from the poles to the operating room through two 100-wire Patterson aërial cables. The cables terminate on the large 60-foot pole in front of the office. This pole is double cross-armed to receive the wires from both ways, and equipped for 280 lines. The manner in which the lines are carried from the outside wires to the cable box is new, and is the invention of Chas. H. Wilson, assistant genera superintendent of the company. A groove is cut on the face side of each arm where the wires are carried under a galvanized iron cover (removable at will) to the centre of the pole, where they enter a trough from the back side, which extends from the top of pole to the lower cross-arms, which is also covered with a removable iron cover. The wires through this trough enter the cable box situated on the lower cross-arms, where the cables terminate. The wire used on the pole is No. 18 office wire. There is between 4,000 and 4,500 feet strung on the pole. In the office is a cross-box for the protection of the board against electric light and other strong electric currents, the working of which is a pronounced success. Each subscriber's line passes over a bronzed plug which is insulated from the line by a thin film of mica. The opposite end of the plug rests against a stiff spring, which is connected with the ground. The line wire holding the plug in position is a very fine copper wire, which will fuse easily, releases the plug which is thrown by the spring out upon the office floor, leaving the wire grounded and notifying the operator that the line is open. The cross-box is set adjoining and parallel with the key-board.

The office is conveniently arranged, well lighted and airy, and is a decided improvement over the old.

The entire exchange has been overhauled and put in first-class shape, and a new line of 50-foot poles built from the Fox river bridge to central office.

Mechanical Telephones.—Prof. W. E. Ayrton writes upon this subject to *Nature* as follows: "In connection with the subject of mechanical telephones, which has been occupying public attention lately, there is a note by Mr. Miller in a recent number of *Nature* regarding certain experiments made in 1878 on the propagation of sound. With reference to this, Prof. Wernhold, of Chemnitz, writes to me, saying that as early as 1870 he had shown that human speech could be transmitted very distinctly through stretched wires or threads, and mentions that the results of his researches were published in an article on 'The Transmission of Human Speech through an Iron Wire,' in Carl's 'Repertorium für Experimental Physik,' Band vi., Serie 168."

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Nov. 9, 1885.

Mr. Theo. S. Kauffer, No. 51 State street, reports a very steady demand for his open-circuit battery.

Messrs. G. F. Milliken & Co., No. 70 Washington street, report the sales of the "Reis telephones" as being very satisfactory; in fact, so numerous have the orders been of late that they find it impossible to manufacture goods fast enough, and they are making arrangements for enlarging their premises and increasing their facilities. The firm is in receipt of many letters from parties who have been supplied with the Reis instrument, in which high encomiums and congratulations are expressed.

At the Institute of Technology the first social meeting of the society of '88 will be held on Friday, Nov. 18. Mr. W. W. Jacques will give a course of lectures on telephone wires, etc., before the Senior Electricals in December. The Mechanicals and Electricals of the third year, in sections of six, are having a course in photography of six exercises under Professor Pickering. A technical society, similar to the one recently formed in the biological department, has been formed by the fourth year Electricals and their instructors.

Recently, Mr. J. M. Oram started on a western trip, principally with the object of introducing his meritorious and reliable telephone time repeater.

Mr. Oram arrived in St. Louis the latter part of last week, and in his letter to the Boston Company he reports having placed quite a number of his instruments *en route*. The Telephone time repeater which Mr. Oram is introducing at various points in his travels is somewhat more simple in its mechanism than the one first brought before the notice of the public, and which was described at length on page 33 of THE ELECTRICAL WORLD, issue of July 25, 1885. It is smaller and more compact in form than the other, and is operated by a spring motor, which is intended to be wound up daily, the same as an ordinary clock, requiring no additional attention. It also contains a signaling relay for connecting with any district telegraph messenger system, whereby time signals may be given every box holder. To explain: A small bell is attached to each messenger call-box, and the box holder desiring the time-signals merely presses a small button, which places the receiving bell in circuit with the time repeating instrument, and the hour, minute and second are accurately and distinctly tapped. Another feature possessed by this instrument is its safety circuit, which is so arranged that it can prevent the transmission of erroneous signals, while the bell and time indicator are in circuit. One cell of gravity battery is sufficient to operate the entire apparatus, and the instrument may be relied upon to give absolutely true time.

Mr. V. J. Mayo, formerly of this city, is now traveling in Pennsylvania and New Jersey for the Consolidated Electric Light Company of New York.

The Wheeler Reflector Company, of this city, is making a large quantity of incandescent lamp reflectors, to meet the rapidly growing demand from manufacturers and business men using incandescent electric lamps. It has been ascertained that the Wheeler reflector is a useful adjunct to the incandescent lamp, as it greatly enhances both the beauty and strength of the light.

Mr. Alexander reports the new plant in the factory of the Boston Woven Hose Company, at Cambridgeport, as being nearly complete, and says it will be ready to light up on the 15th inst. Mr. Geo. A. Mayo, of this city, has had charge of the wiring and installation of this plant, and his work has received very high praise.

The New England agency of the Consolidated Electric Light Company, Mr. P. H. Alexander, agent, has recently received several very satisfactory orders for the installation of the Sawyer-Man system of incandescent lighting.

The Electrical Development and Manufacturing Company has just purchased a mammoth engine lathe. This company will hereafter manufacture most of the Fuller-Wood apparatus for the use of the American Electric Manufacturing Company.

The Ball system of electric lighting has been for many months attracting a good deal of comment and criticism, partly owing to the peculiar construction of its dynamo, which is decidedly different from any other, and in part to the claims set forth by the inventor, Mr. Charles E. Ball, of Philadelphia.

The unipolar dynamo is the novelty of the Ball system, and the feature that distinguishes it from all others is that it has two armatures, each of which rotates within the inductive influence of only one pole of a field magnet, while other forms of dynamos have one armature rotating within the inductive influence of two poles.

The promoters of this enterprise make the following claims as to the excellent qualities to be found in the Ball "Unipolar inductor" dynamo:

The current is very regular and produces an unusually steady and uniform light. It will sustain at the same time two circuits of lamps, one of the arc class and another of the incandescent, or it will run either class independently. Its capacity and performance are very remarkable, which may be inferred from the fact that one dynamo for operating 20 arc lights weighs but 780 pounds, while 2,000 pounds is a light weight for one of equal capacity of any other system. It does not generate undue and excessive heat in its armatures, and consequently they offer with it no cooling device or ventilating apparatus, such as blowers, air blasts, fans, etc. It possesses the prevention and requires no cure. It does not require to be run at an exact speed, and any power of ordinary uniformity will produce good light. Its mechanical detail will, upon the most thorough examination, be found all that can be desired. The shaft is steel, the bearings are bronze, and the iron work is forged. The commutators are composed of unusually pure copper, formed by a peculiar process, which gives it great density and secures a uniform wear. The wear of the commutators and the consumption of brush copper is remarkably slight. The workmanship throughout will bear the closest inspection. The Ball arc lamps are of various designs. They are substantially constructed, and require practically no adjustment after leaving the manufactory; and when once adjusted remain so. It is specially adapted for isolated plants because it does not require the attendance of an electrician; any person of ordinary intelligence can be taught in a few hours to operate it with perfect success.

One of the most successful installations of the Ball system in the New England States is the plant at the Providence Worsted Mills, Providence, R. I. In the early part of last spring Mr. Charles Fletcher, the owner of the above-named mills, consented that a small plant of 20 arc lights be installed simply on trial, and so well pleased has that gentleman been with the system, that he has increased the number of the lights (same system) from time to time, until the plant now comprises the following: One 30 light dynamo machine, running 35 lights; one 20 light machine, running 19 lights; one 20 light machine, running 21 lights, and one 20 light machine running 20 lights; making a total of 95 arc lights of the Ball system now being in constant use. Mr. Fletcher, on being questioned, without any hesitancy said: "The Ball system, in use in my mills since last spring, has proven all that is claimed by its promoters, and has not only afforded an efficient and reliable light, but has given thorough satisfaction." The engineer of the same mills, Mr. Nathan Slater, who enjoys not only the confidence and esteem of his employer, but is the possessor of a reputation for being a skillful mechanic, as well as a competent engineer, has had exclusive control of the running of the Ball plant in the Providence Worsted Mills since the day of its installation, and his opinion is worthy of mention.

In reply to queries put to him in regard to the Ball system, he remarked as follows: "I have been in charge of these dynamos from the very day that they were placed in this mill, and have never experienced the least amount of trouble with either of them. Having had considerable experience (previous to taking charge of the Ball dynamos) around mills where various systems of electric lighting have been in use, I consider myself competent to give an unbiased opinion of a good electric lighting system, more especially after being in charge of same for nearly nine months. I take pleasure in saying for the unipolar dynamo of 20 lights, it runs easily and smoothly, and can do the work required just as well with a two inch belt as with a larger one.

"Have had all four dynamos at times running steadily for 16 hours, and no excessive heat could be discerned on the armatures or fields of either.

"They derive their power from a 350 horse-power engine made by Geo. M. Corliss, of Providence, which also drives 152 looms for weaving cloths, four sets of cards, three sets of jacks, together with all the machinery used in cleaning, scouring and finishing.

"The belting to each dynamo runs from off a countershaft, and although each belt is laced, yet the arc-lights show no imperfection, always burning clearly and steadily without a hiss or flicker. My confidence in the unipolar dynamo is deep-reached and sincere."

Messrs. Taft, Weedon & Co., of the Weybosset Mills, only a short distance from the Providence Worsted Mills, learned of the satisfactory performance of the Ball lights at the works of their neighbor, and soon made up their minds to have the same system, and recently had a 20-light unipolar dynamo installed in their engine room, and are now running it from the ordinary shafting of the mill by a 2½-inch belt. At present only 20 arc lights are being used, but these are giving satisfaction.

The Edison Company is installing a 100 light plant in the machine shop of Mr. F. E. Reed, Worcester.

The Tarbox Time Register Company, No. 20 North street, this city, are manufacturing large quantities of their reliable and handsome electric clocks to enable them to fill orders already in hand.

The Pidgin Electric Calculating Machine Company, at No. 54 Devonshire street, is busily engaged at present in making changes in the mechanical arrangement of its ingenious apparatus. Before placing the machine on the market the company is determined that it shall be free from any liability of making the slightest error, and to that end labor and expense are not being spared in perfecting and strengthening all the parts of the entire apparatus.

There is on exhibition at No. 1 Pemberton square an ingenious model exemplifying a new system of rapid transit. The work is the result of years of labor by Mr. John A. Enos, a young electrician, and consists of a passenger-car suspended from a rail upon which runs an electric motor. The latter is of the Daft pattern, and receives its power from an electrified rail, furnished from powerful steam dynamos. The cars may be either suspended in the air or move near the ground. The cars are lit by electricity and worked entirely from the inside. The elevated track, being a single rail, does not darken the street. A stock company is being formed to introduce the system in Boston. The patentees have about completed arrangements to put it in operation between Lynn and Nahant. The Legislature will be applied to for the granting of a charter and the right of way through the city.

PROVIDENCE, R. I., Oct. 31, 1885.

Some fifty inventors of the Providence Franklin Society, an old and well-endowed scientific society, have organized an electrical sub-section, in order to more fully discuss electrical subjects. The following list of officers indicates that the various electrical interests are well represented: President, A. C. White, Superintendent Providence Telephone Co.; Vice-President, Wm. H. Sawyer, Secretary American Electric Works; Secretary, F. A. Osborne, Manager B. & O. Telegraph Co.; Treasurer, Chas. H. Douglass, Manager Providence Electric Supply Co.; Executive Committee, A. C. White; J. W. Duxbury, General Manager R. I. Telephone and Electric Co.; J. I. Drake, Superintendent Rhode Island Electric Lighting Company; V. A. Thomas, Superintendent Narragansett Electric Light Company; H. A. Bowen, of R. I. Electric Lighting Company. Library Committee, E. W. Blake, Jr., Professor Brown University; H. A. Bowen; E. M. Carhart, Manager Holmes Burglar Alarm Co.

The iron front of the Low Building, Westminster street, was found, a few days since, to be charged with electricity. The discovery was made by a district messenger boy, who was seen to measure his length upon the sidewalk, and then run away screaming with terror. A plumber carrying a piece of pipe next made a contact, and he and the pipe rolled into the gutter, to the amusement of a large crowd. After several had shared a like experience, the police formed a cordon until an electric light wire was removed, when the excitement ended. The attendant of the dynamos at the Riverside Mill also recently received a shock from a forty-five light Brush arc machine, and was severely burned. He was adjusting the brushes, and it is supposed that the contact was made through his wet garments, as several holes were burned through his clothing. He was seen to fall among the wires, and was quickly removed, but not before several deep holes were burned in his flesh. He described his experience upon regaining consciousness as simply terrible from nervous suffering, accompanied with intense physical pain. He is rapidly recovering, and has resumed his work, though one or two deep ulcers give evidence of his narrow escape from death.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
1,000 WALNUT STREET, PHILADELPHIA, Nov. 9, 1885.

At last city councils have passed, and the Mayor has signed, an ordinance granting to the Western Union Telegraph Company, the Bell Telephone Company and the Philadelphia Local Telegraph Company permission to place jointly their wires and cables under certain streets for a distance of about three miles. All the companies named are in earnest in their proposition to put the wires underground, the Western Union having already purchased considerable material for the purpose; but the lateness of the season will preclude any extensive work. It will not be let out to contractors, as the companies intend to do it themselves. The ordinance prescribes that the work authorized must be completed within one year, so that with the opening of spring there will be great activity in underground construction, and Philadelphia will soon have an extensive subterranean telegraph system. The Baltimore & Ohio Company has done little or nothing in this line, and if it will not have been consolidated with the Western Union by this time next year, it will become involved in a costly snarl with the municipal government over its aërial lines.

The Associated Press operators are still hammering away at the type-writer, and its popularity among telegraphers is becoming more and more marked. Several of the Western Union operators, who have been so much smitten with its beauties, as are the compositors, are assiduously "practicing." Some of them are talking of forming clubs of two or three each, to buy type-writers of their own, and then practice at their homes—one man sending on a local Morse circuit while the other receives, *i. e.*, copies the matter on the type-writer. Should this idea spread we shall soon see type-writers on the commercial lines—the operators owning the instruments—and the public will be greatly benefited thereby. Meanwhile the Remington agency, at 715 Chestnut street, is kept busy answering the great and increasing demand for machines. There are four at work in the Associated Press office here, and since the operators have discovered that it is impossible to "salt" them—the receiver being easily able to put down 60 words per minute, while the sender at his best cannot transmit 50—they are correspondingly happy.

The electric conduits are well under way on Ridge Avenue, and the electric railway on that thoroughfare will soon be a fact.

A decree was entered in the United States Circuit Court on the 2nd inst., in the suit of Andrew D. Hepburn against the Richter Electric Light Company, ordering that the latter pay to the complainant the sum of $2.172, or letters patent held by the defendant company will be sold by the United States Marshal.

The electric light is spreading rapidly in the coal regions. Pottsville will be lighted by electricity on the 16th inst. The erection of the poles has been completed and the stringing of the wires is now in progress. Thirty arc lights will be used as a beginning.

A broken electric light wire caused great excitement in Wilmington, Del., on the 2d inst. The break occurred in front of Adams & Brothers' store. The electric current distributed itself in a shower of fiery sparks that made it look as though the store front was on fire. A clerk in the store ran out and dashed a bucket of water on the supposed fire, but only succeeded in diverting upon himself a shower of severe electric shocks. He then procured a hammer and attempted to dislodge the broken wire, but the second time he drew back his arm he struck a small boy who was crowding eagerly forward to see the fun, and broke out two of the lad's teeth. Finally the excitement was allayed by disconnecting the broken wire from the circuit, which might have easily been done in the first place.

Mr. Charles Stowell, an old and very thorough electrician, called at this office last week and expressed much admiration at the great progress made in electrical matters in Philadelphia recently. Mr. Stowell, who was formerly connected with the Wallace Company, of Ansonia, Conn., is now representing B. S. Hale and Son, the extensive covered wire manufacturers of Boston and Malden, Mass.

There are so many old electricians and operators making a good income now in connection with the manufacture and sale of electrical supplies and materials, that it is surprising that so many others of the old guard are still to be found plodding away "at the key."

PITTSBURGH NOTES.

PITTSBURGH, Pa., Nov. 3, 1885.

The Board of Inspectors of the Western Penitentiary advertised some time since for proposals to furnish a plant of arc and incandescent lamps to light the new Riverside prison, now under course of erection. They have, within the last week, decided to ask for new proposals, for an incandescent plant *only*, and in the course of a few weeks they will open the new bids. It will require about 1,500 incandescent lamps, and will be used for both window and outdoor illumination.

The St. Charles Hotel has just ordered an incandescent plant from the McTighe Electric Light and Manufacturing Company of this city.

Mr. J. M. Gushy, who now has a large Thomson-Houston and Edison plant, proposes to increase the same in a short time.

The Brush Company has installed a large plant, both arc and incandescent, for Messrs. J. Kaufman & Bro.

The Union Switch and Signal Company has just received from Europe a Siemens alternating dynamo to be operated in connection with the system of Gaulard and Gibbs, for distribution. The plant has been set up and is in operation at the company's works. Mr. Geo. Westinghouse, Jr., is arranging to introduce the system in this country.

The offices of the Philadelphia (natural gas) Company are now illuminated by the Stanley 75 c. p. lamps, operated from a plant at the Union Switch and Signal Company.

The Union Switch and Signal Company is manufacturing the Stanley lamps very extensively, and from the reports received they are giving good satisfaction.

The McKeesport Light Company is about ready to start the Edison system, which it proposes to operate in

connection with the Thomson-Houston system of arc lighting.

It will start with a plant of 1200 lamps, and have them all subscribed for at this time.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Nov. 7, 1885.

Among the examples of phenomenal success illustrative of Western enterprise may be named the McIntosh Galvanic and Faradic Battery Company. Less than five years ago the company was organized for the manufacture of medical electrical apparatus, and began business in a small structure at the corner of Fifth avenue and Jackson street, this city. From the first success attended them, and their business grew so rapidly that last spring they were obliged to remove to more commodious quarters. They now occupy the new seven-story block at 300-2 Dearborn street, and by the courtesy of Dr. McIntosh, I was permitted lately to visit the various departments into which their business is now divided. On the first floor, entering from Dearborn street, we found their large and handsome office filled with a force of correspondence clerks busy with the large mails which are the result of liberal advertising. I was told that their correspondence extends to nearly every civilized country. Passing through the office, I entered the salesrooms where, displayed in elegant cases, may be seen samples of the extensive line of apparatus they manufacture. Among these is their 18-cell combined battery, which was given the preference by the United States government, on competitive test, for use in United States hospitals throughout the country. It furnishes the faradic currents of various strengths required in medical practice, as well as a galvanic current from a series of galvanic cells arranged in sections of six. Another battery shown me was the Physician's Faradic, and another good one was the Family, which I found on trial to be well worthy of the name "Little Giant," sometimes given to it. Outside of the numerous batteries, is a very large and interesting line of accessory instruments and apparatus. Their bullet probe attracts attention by its ingenuity and simplicity. The stock of electrodes is the largest I have seen. They make nearly a hundred different styles, most of which are of their own design. Passing through the salesroom on our way to the elevator, I caught a glimpse of the large and convenient shipping department fronting on Fourth avenue, where a large force of men and boys was actively engaged in assorting and marking the day's shipment.

On the second floor I saw a large show room, in which are displayed the elaborate and beautiful office and bath apparatus designed and manufactured by this company. Adjoining this show room we found the finely equipped optical department. Beginning three years ago with the manufacture of their well-known Solar Microscope and Stereopticon Combination, they are now making several styles of microscopes and the finest lanterns for projection in America. A large room is fitted up expressly to show intending purchasers the actual working of the Solar Microscope and Stereopticon, either with sunlight or with the ether-oxygen light, which latter is rapidly superseding all other forms of light for lantern work. The company also shows a fine line of static apparatus. Their two-plate and four-plate machines are not excelled in power or certainty of action when needed. The fact that they are readily charged without delay, in all states of the weather is a feature for which they claim special mention, while their static electrodes are, it is said, the finest made anywhere. On either hand may be seen instruments for experimental work in schools and colleges of which it is impossible here to make mention. Adjacent was the Doctor's laboratory which contained a vast array of material in the various stages of uncompleted experiments. On the same floor was found the editorial room, where can be seen on file all the current medical and electrical publications, and where material is prepared which keeps constantly busy the printing department on a floor above, where a considerable force is employed exclusively in the work demanded by the business.

Mention should be made of the rubber department, where is carried on the work of turning sheets of rubber gum into the black hard rubber cells with which all the portable batteries are supplied.

We next passed into the battery department, where, amid the hum of machinery which entirely filled the upper floor of this extensive establishment, skillful mechanics were engaged in the manufacture of all parts of the innumerable kinds of apparatus pertaining to the electrical department, presenting a cheerful sight of active industry. Across the hall was the shop wherein are made the delicate optical apparatus. The repair shop should not be overlooked, as it forms by no means the least important adjunct of the business, being the only place in the West where any make of battery, home or foreign, can be repaired. This firm made a fine exhibit of their goods at New Orleans during the late Exposition. They were rewarded with the gold medal on batteries and also on their specialty, the solar microscope and stereopticon combination, notwithstanding keen competition on the part of manufacturers, both at home and abroad. They have extended their trade throughout the United States, and have established agencies in Canada, Australia and Mexico, and have already made some advances in the South American trade. We were shown their catalogue in Spanish and other evidences that the company are ready to meet any opportunity to further develop their business. It is such firms as these that give Chicago pre-eminence as the trade centre of the Northwest.

The Railway Telegraph Supply Company have secured the repair work of the Western Union Company.

A delegation of Milwaukee aldermen visited Chicago this last week, for the purpose of inspecting the underground and overhead wire system here with special reference to electric lighting. Milwaukee is at present trying to decide what kind of an ordinance she will grant for electric lighting companies to operate under, and the result of the visit of the city's aldermen here will probably be shown in the further action which they take in the premises. It will be remembered that the Milwaukee Council passed one electric light ordinance which seemed to be a very good one for both the city and the operating companies, but it was vetoed by the Mayor.

The electric light plants in the Chicago City and Cook County buildings are rapidly approaching completion, the City Hall plant being, in fact, already in operation. The work in the County buildings seems to progress a little more slowly, but another week will probably finish that.

Mr. T. J. Foley, of North Platte, Neb., has accepted the treasurership and management of the Sperry Electric Light Company, of Chicago, and besides taking the active management, brings large additional capital into the company. Mr. Foley has been for some time interested in the Sperry local plant at North Platte, and now associates himself with the manufacturing company at Chicago. Mr. Foley is a young man, only 34 years of age, who has made a fortune for himself in conducting a general mercantile business at North Platte. After becoming interested in the local electric lighting company, he made a thorough investigation of the Sperry system, with the result above stated. This puts the Sperry Company on a basis financially solid, and in better shape than ever before. With Mr. Sperry in the laboratory, and Mr. Foley in the business management, a large increase in the company's already very satisfactory business may be confidently looked for.

The Milwaukee Electric Works is a new firm, with headquarters at 144 Mason street, Milwaukee, Wis.

A very ingenious little instrument is the "Lightning" Speed Indicator of the McDonnell Odometer Company. The face of this instrument is hardly larger than a silver dollar, but it is claimed that it will register as high as 1,000, and that it will stand over 10,000 rotations per minute, registering every revolution of the shaft.

GREELEY, COL., Oct. 30, 1885.

Greeley is an enterprising town of the West, and is by no means behind the times on the question of light. Although the town is only fifteen years old, it has now a population of nearly 4,000, with greater possibilities for the future under the influence of the mild climate of Colorado and the productive country round about. The need of some better light, than that furnished by coal oil has long been felt. The question of lighting the town with gas has been repeatedly deferred in the hope that the electric light would soon be perfected for all practical purposes. During the past summer the Greeley Electric Light Company was organized and immediately a gas company applied for a charter to furnish the town with gas. A bitter struggle for existence ensued which resulted in final victory for "electric light." The people, knowing that the town was not large enough to support both companies, refused to grant the gas company a charter, prefering the electric light. The electric light company have gone to work in good earnest and are now building a station for incandescent lighting. The plant is centrally located in the heart of the town, with a possibility of two thousand lights within a radius of 2,000 feet from the plant. Two 300 light Brush dynamos have been ordered to begin with, also two forty-two h. p. Armington & Sims high-speed engines. The engines will be belted directly to the dynamos. The boilers are being built in Dayton, Ohio, and will be furnished with the Jarvis settings. The entire steam plant is being furnished by the Pond Engineering Company, St. Louis, Mo. The building, which is now in process of construction, will be 50 by 115 feet, and is of brick. When the plant is completed it will be one of the most thoroughly equipped central lighting stations in the West. It is expected to have the plant in successful operation by Jan 1, 1886.

THE TELEGRAPH.

General Hazen has gone from Washington to Boston for the purpose of superintending the laying of the new signal service cable that is to connect Nantucket with the mainland.

The Spider and the Flies.—About thirty of his pupils are now anxious to prosecute Joseph P. Hellehen, who has been running a telegraph institute in Boston for some time past. The Boston papers report him under arrest, the police having broken up his business.

A Telegraph College in Trouble.—A dispatch from Oberlin, Ohio, on the 7th inst., says: The Oberlin Telegraph College is in trouble. Some of the students have lately had their eyes opened to the fact that things are not what they expected. Five of the students have clubbed together, each depositing $25, and have secured the services of an attorney with a view to recovering their tuition fees and if possible bringing the proprietors of the college out in their proper light.

THE TELEPHONE.

Copper Circuits.—The New England Telephone Company has completed direct copper wires from Boston to Worcester, and from Boston to Portland, points heretofore reached with difficulty by telephone.

The Usual Plea.—The trial has begun at Salem, Mass., of Henry K. Goodwin, who killed Albert D. Swan, with whom he was interested in telephone inventions. It is evident that the plea of insanity will be entered.

Not Ready.—A recent dispatch from Baltimore says: "The case in the United States Court of Bell against the Pan Electric Company, the Bell applying for an injunction, is postponed, probably for three weeks or more, by request of the Pan Electric Company, which is not ready to proceed."

Telephoning between Trains.—At Albany, N. Y., on the 7th inst., Thomas A. Edison, Ezra T. Gilliland, Samuel Insull, John C. Tomlinson, Charles Batcheler, John Kruesi and John F. Randolph incorporated the International Railway Telegraph and Telephone Company, capital $1,000,000, to operate telegraph and telephone lines between trains in motion, etc. The operations are confined to countries outside of the United States and Canada.

Wrath in Worcester.—It is reported from Worcester, Mass., that at a meeting of about 100 telephone subscribers, dissatisfied with the recent advance in rates, held on Nov. 5, it was unanimously voted that those present would order out their telephones Nov. 15, unless the company restored the old rates and gave guarantees of better service in future. It was stated that between one third and one-half of the subscribers to the local exchange have already signed a paper to this effect.

Suing the Syndicate.— A dispatch of Nov. 5, from Lowell, says with regard to the well-known trouble there: "The property of William A. Ingham, C. J. Glidden, Loren N. Downs, Alonzo A. Coburn and William H. Bent, the original telephone syndicate, has been attached for $150,000 each by Gen. Butler and William H. Anderson, on behalf of the Erie Telephone Company, in a suit to recover $127,000, the amount of money paid for certain properties in the West, in which it is alleged the syndicate committed fraud against the company in that they sold it to the Erie Company at an advance of $37,000 above what they paid for it while directors of said company. This is the outcome of a special meeting of stockholders held at Albany in September."

THE ELECTRIC LIGHT.

Officers of the Consolidated.—The following gentlemen were elected on Nov. 6, by the Board of Trustees, as officers of the Consolidated Electric Light Company: President, Chas. H. Banes; Vice-President, H. R. Gardner; Treasurer and General Manager, Henry C. Davis; Secretary, W. Richardson.

Brooklyn Elevated Railroad.—Gas does not answer the requirements of the Brooklyn Elevated Railroad, which has a great many exposed stations. The company is in favor of incandescent lighting, and will in all probability try that system first on the new Fulton Ferry Station. If it proves satisfactory there, it will be adopted over the entire road.

APPLICATIONS OF POWER.

A Proposed Line for Nahant, Mass.—There is a project to put down a new street railway in Nahant, Mass., and electricity is to be the motive power. Another hearing will be given by the Selectmen on Nov. 19.

Philadelphia.—The managers of the American Electric Railway expect to run their cars at a cost of $4.74 each per day. The work is now nearing its completion under the able direction of the electrician, Mr. W. B. Schlesinger.

A Simple Domestic Motor.—In referring to our article with the above title in the issue of Oct. 3, a correspondent at Leadville, Col., sends us a sketch showing a small motor constructed by him, and run in Brush arc light circuit. It is a small double motor of the Page type, with levers arranged so as to break contact at the right point.

PERSONALS.

W. Stanley, Jr.—We understand that Mr. W. Stanley, Jr., whose incandescent system is now being furnished by the Union Switch and Signal Company, has taken the old Day factory at Great Barrington, Mass., and will equip it at once in a very complete manner as a laboratory. It is reported that he will experiment, among other things, with the system of distribution by means of secondary generators.

Miss Ada C. Sweet, who was pension agent at Chicago for eleven years, and about whose displacement there was so much talk recently, has come to this city to engage in business. She is the agent for an electrical device for shutting off steam in buildings and for regulating the supply of steam. Her younger sister is her companion and secretary. Miss Sweet is not the masculine being that one would picture from a knowledge of the fact that she had managed a great Government office. She is feminine in appearance, with blue eyes and golden hair, and the only traces of masculinity about her are the lines of her face, which indicate decision and firmness. The whole country can honor in her womanhood the sacrifices she made for the sake of her large family of orphaned brothers and sisters in taking the office that her father had filled up to the time of his death.—*New York Graphic.*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 65¼, a 69; Am. Dist., a 28; B. & M., b 2; Western Union, b 76¼, a 76¾.

Telephone.—Am. Bell, b 175, a 176½; Erie, b 27½; Mexican. b 1 1/16; New England, a 29; Tropical, 80.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales, 16 Maiden lane, New York.

Card from the United States Electric Lighting Company.—Special attention is called to the foot-note of the Edison Company's advertisement, which has been running since August 15 in this paper, in which they give us a gratuitous notice in their conspicuous attempt to mislead the public. The Chicago *Times* of August 9 read as follows: "The last statement issued by the United States Electric Lighting Company develops the fact that during the past year over **53,100** incandescent lights were installed or contracted for by that company, instead of 3,100, as stated in yesterday's *Times.*" The Edison Company seem to be clutching at treacherous straws.

Hale's Honey,
The great cough, throat and lung cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals—beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown: 50c.
PIKE'S TOOTHACHE DROPS, will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.

MISCELLANEOUS NOTES.

Franklin Institute Awards.—The following awards of the John Scott legacy progressive medals have been recommended at the meeting of the Franklin Institute: For improvements in sleeping cars, John H. Doerr and William H. Wymore, of Philadelphia. For journal bearings, Samuel Wills, of Camden. For three kinds of machines for shoe operating, Cyprien Chabot. To Frederick Siemens, of Dresden, for his regenerative light; Paul La Cour, of Copenhagen, for his phonic wheel; P. B. Delany, of New York, for improvements in multiplex telegraphy. The award of the Elliott Cresson gold medal was recommended to Siemens, Delany and Chabot.

"Industrial America."—The issue of this paper for Nov. 7 contains no fewer than fifteen illustrated articles

and twenty-eight fine cuts. Two very interesting articles are, "The Manufacture of Corsets" and "Automatic Weighing Machine," both freely illustrated. An article of novel character is that by Mr. W. Baird on "Fish Culture for Farmers and Others." Among the more important miscellaneous articles are: "American Cannon and Armor Plate," "The Making of Boxes by Machinery," "Fire-Proof Buildings," "Tornado Characteristics." The price of this handsome sixteen-page paper, size of THE ELECTRICAL WORLD, is only 10 cents, every other week. Sample copies and clubbing rates can be had on application at this office. The paper is sold by every newsdealer.

"Johnston's Journal."—The issue of Nov. 14—32 pages and a cover—contains, among other profusely illustrated and timely articles, one on "Riel and His Rebellion;" another on "The Theatre of Conflict in Central Asia;" another on "Civilization and Savagery in Africa," being the humorous experiences and exploits of a missionary in that dark continent; and a full page of sketches showing how cattle are brought from the West to supply Eastern and European markets. There are also illustrated book reviews and a number of bright and readable articles on miscellaneous topics and questions of the hour. In this number, too, begins a powerful serial story, written for the *Journal*, and entitled "Love in Summer Seas," dealing with life in New York and the tropics. The departments have been increased in number and are all well filled. This popular literary magazine, of which each page sparkles with interest, is published every other week by W. J. Johnston, 9 Murray street, New York. The price is only 10 cents a copy, or $2 a year, and it may be ordered of any newsdealer.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED OCTOBER 27, 1885.

Insulator; William N. Faucett, and George F. Huntley, Brooklyn, N. Y..... 328,929

Consists of a narrow block of wood, of less than half an inch in thickness, provided on its face with a number of annular bosses or projections, formed integral with the body or base of the block. Four projections are required for two wires. On the rear side of the block, at each end thereof, cross-pieces are arranged to project sufficiently to allow a small space between the body of the block and the wall, so as to prevent any accumulation of moisture and keep the wood in a dry condition.

Electric Battery; Theodore L. Kaufer, Boston, Mass..... 328,948

Consists of an outer cell, an inner porous cup, a positive and negative electrode, bichromate of soda, and common salt with an acid, preferably sulphuric acid, in aqueous solution.

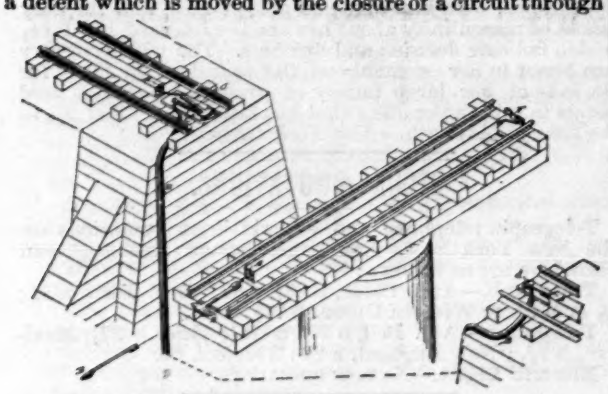
Electric Gas Lighting Burner; David Rousseau, New York, N. Y.....(1), 328,976; (2), 328,977

(1) He employs a simple form of unpacked valve capable of moving with great ease and yet without liability to leakage, and he also uses peculiar ratchet mechanism for operating the valve, arranged in such relation with the electrodes and the manipulating device or lever that one movement of the manipulating-lever forward will open the gas-valve, move the electrodes into and out of contact to produce the igniting-spark, and, finally, lock the valve open.

(2) He pivots a large pawl-lever on the sparking-lever and limits its movement on the sparking-lever by a stop, and connects the pendent manipulating pull to one arm of this pawl-lever, while the other arm of the pawl-lever is arranged to engage a locking projection on the burner in the arc of motion of the lever, and to this end of the pawl is attached a second pull-cord.

Electric Gong; Jacob P. Tirrell, Boston, Assignor by direct and mesne assignments to J. F. Emerson, Wakefield; S. O. Carpenter, Boston, and J. W. Carter, Newton, Mass..... 328,982

Consists in a gong-striking mechanism normally held by a detent which is moved by the closure of a circuit through



329,077. COMMUNICATION WITH MOVING VEHICLES.

an electro-magnet to release the mechanism, and provided with mechanical devices which prevent the return of the detent to its holding position until the desired number of blows have been given.

Telephonic Transmitter; Seth E. Beedy, Farmington, Me..... 329,001

To the rear of the diaphragm is attached a carbon rod. In a frame attached to the case is pivoted a carbon cylinder adapted to press upon the rod and form the other electrode of the circuit. This frame is provided with means of adjustment so that the firmness of the contact of the roller electrode upon the rod electrode may be varied and regulated.

Telephone; Thomas A. Edison, Menlo Park, N. J. 329,030

He covers the granules in a tension regulator with an adhesive substance, such as oil.

Apparatus for Maintaining Electrical Communication with Moving Vehicles; Lucius J. Phelps, New York, N. Y.....(1), 329,076; (2), 329,077

(1) Consists of a switch between the main track conductors and the receiver.

(2) The device is shown in the cut. The operation is such that the switch automatically cuts out the submarine conductor when the bridge closes.

Telephone Receiver; James H. Robertson, Brooklyn, N. Y.....(1), 329,083; (2), 329,084; (3). 329,085

Consist of improvements in his patent 289,309, Nov. 27, 1883. More particularly, they consist of a magnet and a diaphragm capable of magnetic induction, in front of the pole of the magnet and in close proximity thereto, so as to be actuated directly by the magnet, the secondary circuit being so arranged that the secondary current passes through an electrode on the diaphragm, and another vibrative electrode in the said circuit in contact with the electrode on the diaphragm.

Electric Cable Conveyance; Charles J. Van Depoele, Chicago, Ill..... 329,104

Consists of a cable provided with hangers firmly fixed to the under side of the same for the support of the lower conductor.

Electric Governor for Steam Engines; Peter W. Willans, Thames Ditton, England..... 329,112

Consists of a solenoid, through the coils of which the electric current flows. Within this solenoid there is a core suspended by a helical spring. The core is connected by a rod to an equilibrum-valve which is contained within the hollow rod of a piston working in a hydraulic cylinder. From this piston-rod there is again suspended a double-piston throttle-valve regulating the flow of steam or other fluid to the motor.

Dynamo; Clinton M. Ball, Troy, N. Y., Assignor to Joseph A. Powers, of same place..... 329,118

He makes use of field-magnets arranged systematically, the helices of which are of different resistance and grouped together, the helices of low resistances being in the external or working circuit, and those of high resistance being in a derived closed circuit, both circuits passing through the armature, so that the high-resistance helices energize one set or group of field-cores, and the low-resistance helices energize another group of field-cores, and these respective field-magnets being arranged

329,162. WIRE CLAMP AND COUPLING.

symmetrically the electromotive force in the external circuit will remain constant.

Electrical Apparatus Protector; Charles F. Elden, Malden, Mass., Assignor to the American Bell Telephone Co., Boston, Mass..... 329,152

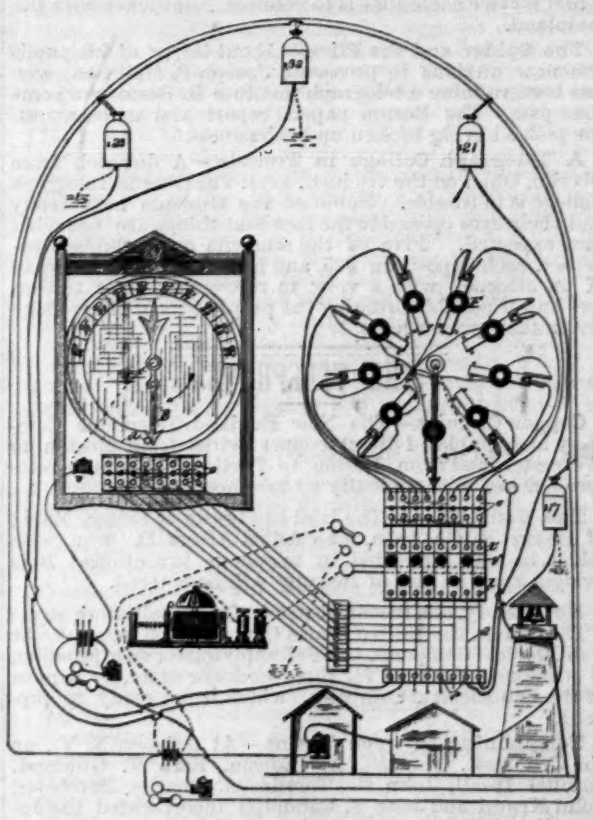
Consists of a fusible strip of metal located in the protected circuit with a ground connection located in close proximity to the end of the fusible strip on the protected side.

Wire Coupling; Emery H. Hamilton, New York, N. Y., Assignor by mesne assignments to Louis Goldsmith, of same place..... 329,162

The idea underlying the invention and the general construction and operation are set forth in the annexed cut.

Electric Arc Lamp; Alfred G. Holcombe, New York, N. Y., Assignor to the Equitable Electric Co..... 329,166

Consists of a rocking lever and actuating electro-magnet, in combination with a carbon-holding rod, a clutch, and



329,188. TESTING APPARATUS FOR FIRE AND POLICE TELEGRAPHS.

two set-screws carried by the lever, whereby the working position of the lever and its range of motion are governed.

Fire and Police Alarms; Lewis H. McCullough, Richmond, Pa.....329,186, 329,187, 329,188, 329,189

They consist mostly of improvements or modifications of the devices shown in the cut, which gives a general idea of the various inventions.

Electric Bolt for Doors; Frederick Sedgewick, Chicago, Ill.....(1), 329,222; (2), 329,223

The general features claimed are mechanism consisting of an air-chamber provided with means for compressing air therein, a valve for alternately admitting said air behind or in front of a piston within a suitable cylinder, the rod of which piston is connected with the bolt-work; an armature connected with said valve and in position to be attracted by electro-magnets having electrical connections with a circuit-breaking mechanism without the safe, and a battery-cup, whereby said magnets may be alternately excited.

Electrical Indicator for Letter Boxes; Ephraim E. Weaver, Philadelphia, Pa., Assignor to Peter I. Fitzgerald, of same place..... 329,245

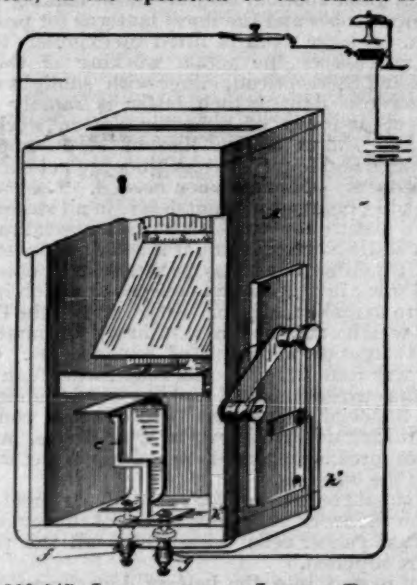
Frequently parcels are delivered which are too large to be put into the box, and thus the automatic circuit-closing arrangement therein is ineffective. To provide against this contingency, he takes from the binding-posts *f g* a branch or derived circuit *h'*, which can be closed or interrupted at will by a manual key *E*, located on the side of the box or in convenient proximity thereto. The postman delivering a parcel too large for the box can by the aid of this switch readily announce the delivery of parcels.

Electric Alarm for Letter-Boxes; Leo Ehrlich, St. Louis, Mo..... 329,294

It is designed to produce a safeguard against the improper entrance into the letter-box by giving notice at a central office. Consists of an arc-shaped strip secured to the door of the box, and guided on the side of said box; a lever pivoted to the side of the box on the interior and having one end in normal engagement with the arc strip; a strip having one end resting on the other end of the lever and the other end secured to the box and engaging or connecting with an electric wire, and a strip having one end secured to the box and connected to an electric wire, and the other end provided with an angle-extension resting under the other strip secured to the box.

Electro-Medical Battery; Thomas H. Hicks, Detroit, Mich..... 329,310

Consists of an induction coil having the terminals of its primary wire connected to four stationary contacts arranged in pairs, each pair forming the terminals of the primary wire of the coil, in combination with a circuit-breaker, carrying two contact springs, which are in electrical connection with the poles of the battery, and which are adapted, in the operation of the circuit-breaker, to



329,245. INDICATOR FOR LETTER BOXES.

form, make and break contacts with each pair of stationary contacts to alternately reverse the current through the primary wire of the coil.

Telephone Transmitter; F. Du Pont Marston, Philadelphia, Pa..... 329,327

He makes use of a diaphragm of glass.

Automatic Harmonic Recorder; Elisha Gray, Highland Park, Ill..... 329,386

Consists in the combination with an analyzer (see his patent 175,971, dated April 11, 1876), which is actuated directly by the electrical vibrations or waves traversing the main line, consisting of a tuned reed or bar and an electro-magnet for throwing the said reed or bar into vibration, of a suitable marking-point, stylus or pen whereby the said signals may be permanently recorded upon paper.

Circuit Controller; William A. Leggo, New York, N. Y.....(1), 329,398; (2), 329,399

(1) Consists of an adjustable contact-block having a metallic and an insulated portion, whereby it may be changed to maintain normally an open or closed circuit.

(2) Consists in details of construction of the above.

Multiple Local Circuit for Telegraphs; Frank L. Pope, Elizabeth, N. J..(1), 329,410; (2), 329,411; (3), 329,412

The three consist generally in an organization of the local circuits of a large telegraph station, by means of which each sounder may be independently supplied with its proper proportion of electrical energy, and may be actuated without appreciably affecting the operation of their instruments supplied from the same source, while at the same time any desired proportion between the resistance of the armature of the dynamo-electric machine and the total resistance offered by the work to be done may be established and maintained.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Please give date and number of patent desired, and address Johnston's Patent Agency, 9 Murray st., New York.